Ref# 8601-006
PR# 267791
30246934

INTEGRA MICROWAVE

MODEL TMF-1800H & J

TUNABLE MICROWAVE FILTER
(TYPE II CONTROL)

OPERATION & SERVICE MANUAL

INTEGRA MICROWAVE
A DYNATECH Company
2368 Walsh Ave., Santa Clara, CA 95051
Telephone: (408) 727-9601/TWX: 910-338-0585

INTEGRA MICROWAVE

MODEL TMF-1800H & J

TUNABLE MICROWAVE FILTER
(TYPE II CONTROL)

OPERATION & SERVICE MANUAL

OFFICIAL RECORDS STATION
FILE COPY
FACILITIES
JUN 23 1988

For serial #4021-351 or higher.

March 1984

WARRANTY

Integra warrants this instrument to be free from defects in material and workmanship for one year from the date of delivery. Damage due to accident, abuse or improper operation, is not covered by the warranty. Removal, defacement, or alteration of any serial or inspection label, marking or seal, may void the warranty. Integra will repair or replace at its option, any components of this instrument which prove to be defective during the warranty period, provided the entire instrument is returned prepaid to Integra or its authorized service facility.

In-warranty instruments will be returned freight prepaid; out of warranty units will be returned freight collect. No other warranty other than the above warranty is expressed or implied. Integra is not liable for consequential damages.

ASSISTANCE

For assistance contact:

INTEGRA MICROWAVE
2368 WALSH AVE.
Santa Clara, CA 95051
(408)727-9601
TWX 910-338-0585

TABLE OF CONTENTS

1.0 GENERAL INFORMATION
- 1.1 Introduction
- 1.2 R.F. Filter Specs
- 1.3 Control Unit Specs
- 1.4 IEEE-488 Control Specifications (Option-02)

2.0 OPERATION
- 2.1 General
- 2.2 Front Panel Features
- 2.3 Rear Panel Features
- 2.4 IEEE-488 Remote Programming (Option-02)
- 2.5 Typical Applications
  - 2.5.1 Reduce Harmonics
  - 2.5.2 Filter Measurements
  - 2.5.3 HP 8340A/TMF-1800H
  - 2.5.4 IEEE-488 Controlled Filter
  - 2.5.5 Analog Tracking with Digital Offset Control
  - 2.5.6 Sweeping Filter with Digital Center Frequency Control

3.0 THEORY OF OPERATION
- 3.1 System Operation
- 3.2 TMF Block Diagram

4.0 CALIBRATION
- 4.1 Internal Voltage Calibration
- 4.2 Frequency Calibration
- 4.3 IEEE-488 Calibration for Option-02

5.0 CIRCUIT DESCRIPTION
- 5.1 General
- 5.2 Circuit Description, Control Unit
- 5.3 Circuit Description, IEEE-488 Interface Board

6.0 SCHEMATICS & ASSEMBLY DRAWINGS
- Interconnect Diagram
- RF-Head Assembly
- Mother Board Schematic
- Mother Board Assembly
- IEEE-488 Interface Schematic
- IEEE-488 Interface Assembly
- IEEE-488 Paddle Board Schematic
- IEEE-488 Connector/Switch Assembly

7.0 PARTS LISTS
Product Structure HPF-220 with IEEE-488 Option-02
Top Assembly Parts List
RF-Head Assembly Parts List
Interconnect Assembly Parts List
Product Structure Control Unit
TMF-Control Unit Parts List
Mother Board Parts List - Page 1
Mother Board Parts List - Page 2
Mother Board Parts List - Page 3
Enclosure Parts List
Panel Front Parts List
Panel Side Right Parts List
Panel Side Left Parts List
Panel Rear Parts List
Harness Parts List
IEEE-488 Interface Board Parts List - Page 1
IEEE-488 Paddle Board Parts List
Option 03 Information
Option 04 Information

TABLES:
Table 1 : F1-Control Range
Table 2 : F2-Control Range
Table 3 : Transmission Codes for IEEE-488 (Option-02)
Table 4 : IEEE-488 Address Codes

FIGURES:
Fig 1 : Front Panel HPF-220
Fig 2 : Rear Panel HPF-220
Fig 3 : TMF-Block Diagram
Fig 4 : IEEE-488 Bus Connection
Fig 5 : F1-Control
Fig 6 : F2-Control
Fig 7 : Band Pass Filter Response
Fig 8 : Frequency Response
Fig 9 : Calibration & Test Set-Up
Fig 10: Parts Location
Fig 11: IEEE-488 Calibration Set-Up
Fig 12: Same as Fig. 3

1.0 GENERAL INFORMATION

1.1 Introduction

The Model TMF-1800H TUNABLE MICROWAVE FILTER provides a new microwave design, measurement and production test capability not previously available in an instrument.

The TMF-1800H TUNABLE MICROWAVE FILTER is a WIDEBAND YIG FILTER which can be electronically tuned over the entire range of 2 to 18.5 GHz by means of a externally applied positive DC voltage. Two different drive sensitivity ranges are provided, .5 V/GHz (0 TO +10 V) or 1 V/GHz (0 TO 20 V), selectable at the rear panel.

The key to the TMF-1800H performance is a single-pole (Triple-pole for TMF-1800J) yttrium-iron-garnet (YIG) filter designed for maximum tuning range and maximum bandwidth. The 3 dB bandwidth is nominally 20 to 50 MHz over the 2 to 18.5 GHz frequency range; selectivity is 6 dB/octave; off resonance isolation is typically greater than 30 dB; insertion loss less than 3 dB. For the TMF-1800J, selectivity is 18 dB/octave; off resonance isolation is typically greater than 70 dB and insertion loss is less than 8 dB.

The selectivity of the Model TMF-1800H allows signal separation and analysis over much larger dynamic ranges than previously feasible. As a tuned postselector for microwave sweepers, synthesizers and signal generators, it can reduce harmonics and spurious output signals and extend the dynamic range of conventional swept or CW-measurements. It can reduce spurious signal outputs an additional 30 dB, improving most sweepers harmonic output levels to -55 to -70 dBc.

The TMF-1800H Control Unit provides controls for a variety of applications. For example, it can convert a comb generator output to a multi-octave signal source by selectively tuning each frequency; it can simplify intermodulation distortion measurements in amplifiers and converters; it can eliminate ambiquity in radio frequency interference (RFI) measurements. In RFI measurements, it replaces five individual octave band filters that are required for equal coverage.

1.2 RF Filter Specifications	MODEL TMF-1800H	MODEL TMF-1800J
Number of Stages	1	3
Frequency Range	2-18.5 GHz	2-18.5 GHz
Bandwidth (-3 dB)	15-70 MHz	15-70 MHz
Insertion Loss (max)	3 dB	8 dB
Passband Ripple and Spurious (max)	0.5 dB	1.5 dB
Off Resonance Isolation (ORI)	30 dB *	70 dB
Limiting Level (min)	+10 dBm	+10 dBm
Off Resonance Spurious (min)	27 dB**	45 dB
Selectivity (nom)	6 dB/Octave	18 dB/Octave
VSWR (typ)	2:1	2 : 1
Impedance (nom)	50 Ohms	50 Ohms
Hysteresis (max)	20 MHz	20 MHz
Max. Input Power	+30 dBm	+30 dBm
Connectors	SMA Jack (3mm)	SMA Jack (3mm)
Size (WxHxL) (excluding RF connectors)	2.75"x3"x3.25"	2.75"x3"x3.25"

NOTE:

* ORI: >-30 dB to 16 GHz; >-27 dB, 16 to 18.5 GHz

** For all frequencies 400 MHz above or below the tuned frequency. (Tracking spurious between Fo ±400: > -6dB)

1.3 Control Unit Specifications

Frequency Accuracy.....	0.1% ± 10 MHz
Frequency Resetability.....	<10 MHz
F1 - Control range see Table 1	
F2 - Control range see Table 2	
Filter tracks analog sweep speeds to 8 ms/GHz.	
Operationg Modes:	
CW or Sweep.....	Apply either a .5 V or 1 V/GHz analog voltage from signal generator to external input.
Temperature Range	10 to 50 degrees C
Control Unit Size (WxHxD)	8 1/2" x 5 1/4" x 17"
AC - Power	115/230 VAC, 50/60 Hz, 50 Watts max.

TABLE 1

F1-CONTROL RANGE

The F1-control range is selectable by internal DIP-switches S1, S2, and S3. The frequency ranges are given in the table below. Any combination of S1, S2, and S3 can be used, and the total range is given by the sum of the individual ranges.

DIP SWITCH			FREQ. RANGE (MHz)
S1	S2	S3	
0	0	0	F1-control disconnected.
1	0	0	±100
0	1	0	±200
0	0	1	±4000

TABLE 2

F2-CONTROL RANGE

The F2-control range is a percentage of the tuned filter frequency. The range can be changed by the DIP-Switches, S4 and S5, located inside the control unit.

DIP SWITCH		FREQ. RANGE (MHz) at 18 GHz
S4	S5	
0	0	F2-control disconnected and -300 MHz @ 18.
1	0	+100 -300
0	1	+200 -300
1	1	+700 -300

1.4 IEEE-488 Control Specification (Option 02)

COMMAND FORMAT: DDDDABC

"DDDD" = Frequency Selection Information

	OPT. -02
# of discret codes	65,536
Calculation Code	HEX
Lowest Code	0000
Highest Code	FFFF
Leading Zeros Req. In Code	Yes
Analog Output Range	0 to +10.000 V
Transmission Code	See Table 3

"A" = Positive Frequency Offset Selection
"A" = 1,3,5,7,9,B,D, or F = Offset ON
"A" = 0,2,4,6,8,A,C, or E = Offset OFF

"B" = Negative Frequency Offset Selection
"B" = 1,3,5,7,9,B,D, or F = Offset ON
"B" = 0,2,4,6,8,A,C, or E = Offset OFF

"C" = ANALOG Input Disable
"C" = 1,3,5,7,9,B,D, or F = Analog Input "OFF"
"C" = 0,2,4,6,8,A,C, or E = Analog Input "ON"

LISTEN MESSAGE DELIMITERS

The following characters are recoginized to terminate a listen data message and will transfer the data.

CR = Carriage Return
LF = Line Feed
1 = Comma

TABLE 3

TRANSMISSION CODE FOR IEEE-488 Option-02

After the frequency selection code is calculated in HEX-format it has to be converted into TRANSMISSION CODE.

e.g. "56BF" ⟹ " 56;?"

HEX-CODE	TRANSMISSION CODE
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
A	:
B	;
C	<
D	=
E	>
F	?

2.0 OPERATION

2.1 GENERAL

The TUNABLE MICROWAVE FILTER is a versatile, wide frequency range laboratory instrument that can conveniently separate or isolate signals on the basis of frequency. The Control Unit provides controls for precisely setting the start-stop frequency end-points, and adjustment for any drive voltage error (1 V/GHz or 0.5 V/GHz input). The RF-Head contains a yitrium-iron-garnet (YIG) filter that can be remotely located from the Control Unit.

2.2 FRONT PANEL FEATURES

Fig. 1 illustrates the front panel controls.

POWER: When AC power is applied to the instrument and the power switch depressed, the power indicator (GREEN LED) will be illuminated.

F1 & F2 FREQUENCY CONTROLS:

These controls are trim adjustments for removing any differences between the YIG filter start/stop frequency end points, and the external drive voltage (1 V/GHz).

REMOTE: When the instrument is under 488 control the remote indicator will be illuminated (YELLOW LED).

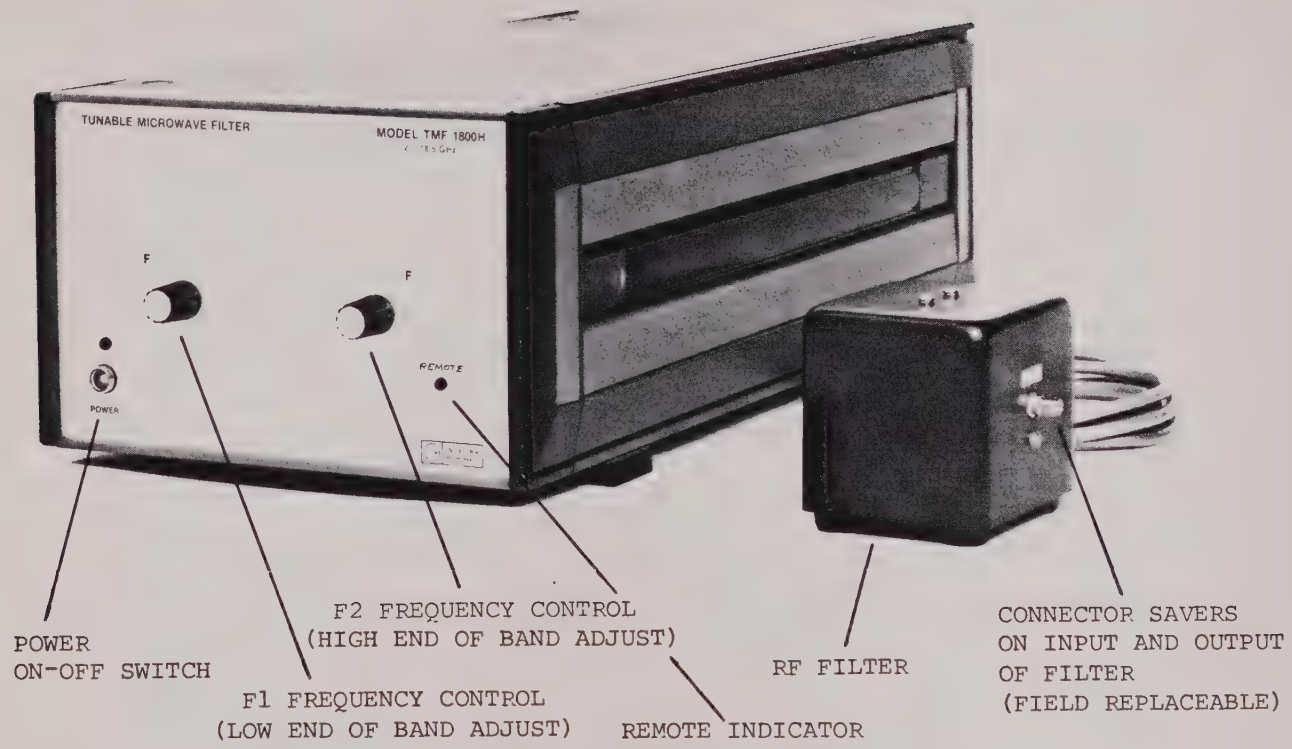


Fig. 1 FRONT PANEL TMF-1800H

2.3 REAR PANEL FEATURES

FIG. 2 illustrates the rear panel connections and controls.

AC POWER INPUT & FUSE HOLDER

For 115 VAC 50/60 Hz operation, use a 1A, Slow-Blow fuse. For 230 VAC operation, use a 1/2 A, Slow-Blow fuse.

FILTER CONNECTOR

This is the RF-Filter control output connector. Use only the control cable supplied with the instrument.

EXTERNAL DRIVE SELECT

Selector switch for 0.5 V/GHz or 1 V/GHz input drive sensitivity.

EXT. DRIVE INPUT

An external analog drive voltage of +1 to +9.25 V (in 0.5 V/GHz mode) or +2 to +18.5 V (in 1 V/GHz mode) sweeps the filter over the frequency range.

DRIVE OUTPUT

An analog output voltage, proportional to the input drive is provided.

IEEE-488 BUS CONNECTOR (With Option-02)

A standard IEEE-488 Bus connector is provided for Bus Control.

ADDRESS SWITCH (With Option-02)

The address switch allows setting of the desired address for the IEEE-488 Bus control.

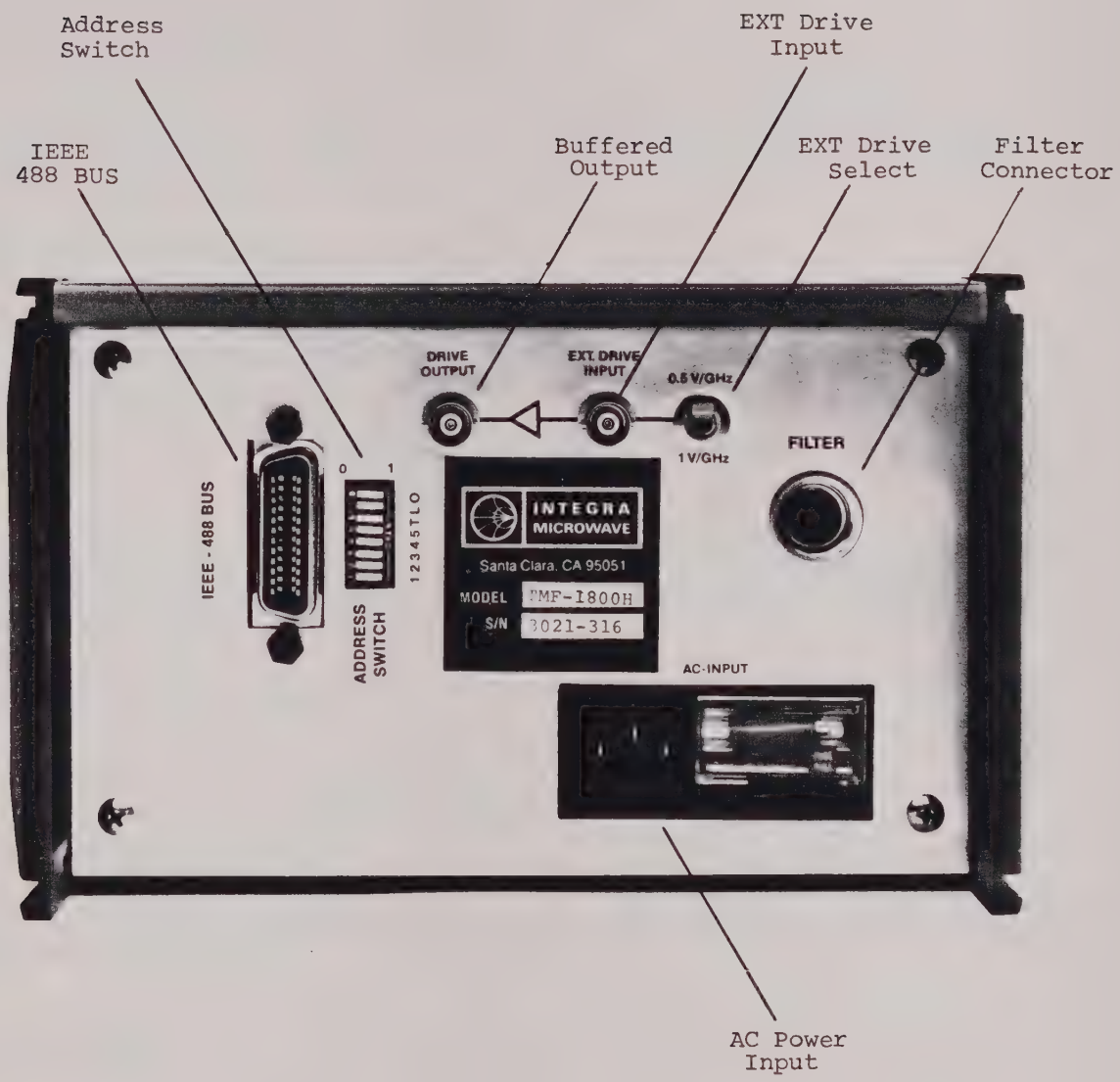


Fig. 2 REAR PANEL TMF-1800H

2.4 IEEE-488 REMOTE PROGRAMMING (OPTION-02)

If the instrument is equipped with OPTION-02, the remote programming control is applied through the rear-panel IEEE-488 Bus interface connector. The addition of OPTION-02 does not affect the normal operation of the unit. (See Figure 3).

2.4.1 REMOTE PROGRAMMING INSTRUCTIONS

A. The 488 Bus uses two modes to communicate between instruments: Command Mode and Data Mode. To control any instrument on the Bus the Command must preceed the Data.

```
OUTPUT 705;"DD...D"
-------- ----
COMMAND  DATA
```

During the Command Mode, the system controller addresses the instrument to be programmed. During the Data Mode, instructions and data are sent to the instrument.

B. The typical system controller command structure for the HP-85 is: *

```
                Instrument address
                      |
OUTPUT 705;"0000000"
       |
Selects output port of the HP-85 controller
```

The above statement sends data to the instrument which has been preset to address "05". (See Figure 4).

*See paragraph 2.4.2

2.4.2 Bus Controller -- HP85 with following options

QTY	ITEM	MODEL NO.	MFG.
1	Controller	HP85A	HP
1	HPIB - Interface	82937A	HP
1	16K Memory Module	82903A	HP
1	ROM Drawer	82936A	HP
1	I/O ROM	00085-15003	HP
1	Advanced Prog. ROM	00085-15005	HP
1	Printer Plotter ROM	00085-15002	HP
1	IEEE-488 Cable (1 meter)		

Bus Controller with all necessary options is available as system -- "IDEA 3001" from Wolf Computer, 301 N. Santa Cruz Ave., Los Gatos, CA 95030, (408) 354-1210, contact Don Wolf.

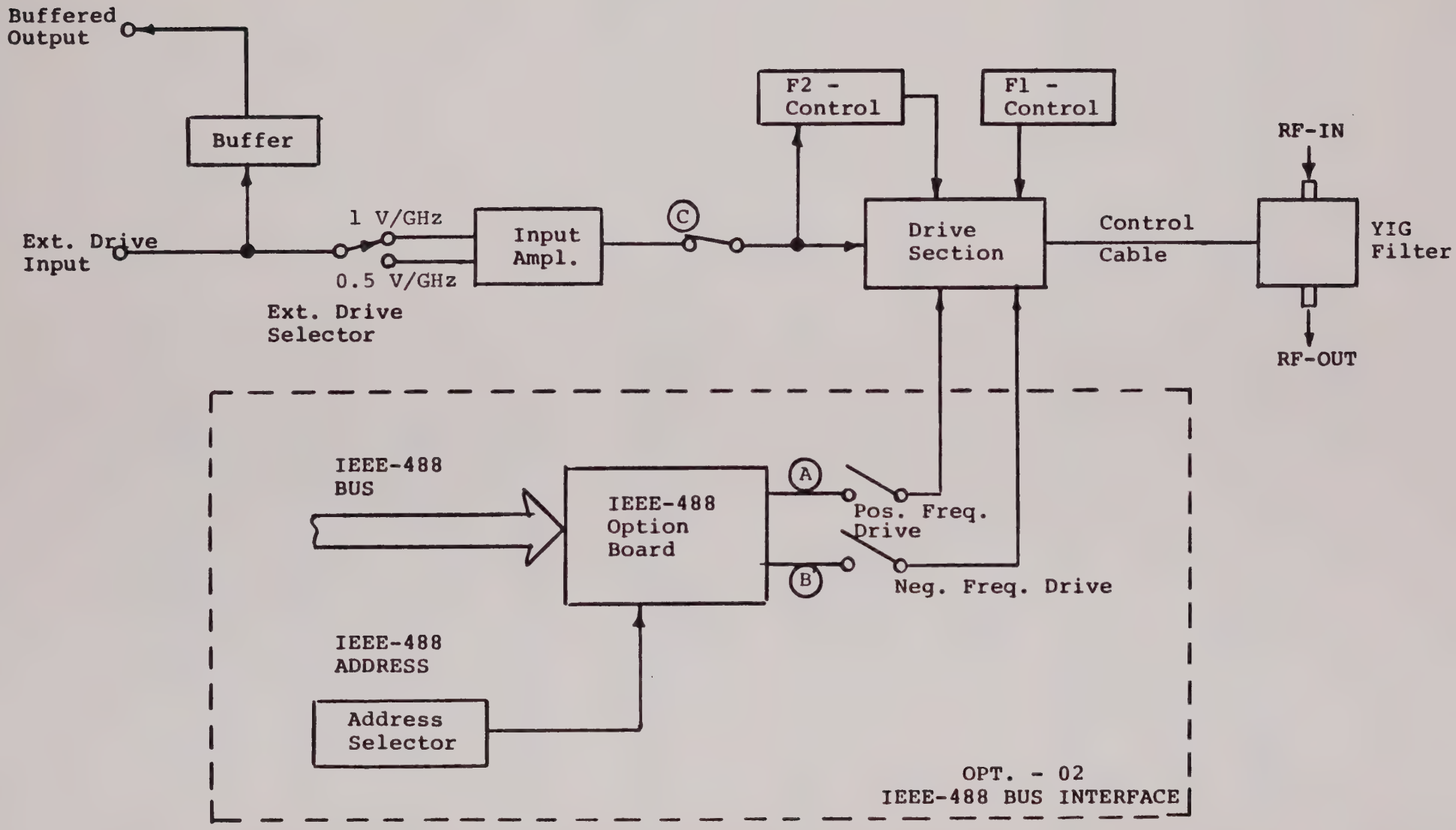


Fig. 3 TMF-Block Diagram

2.4.3 CODE SELECTION FOR HP-85 CONTROLLER

The Option-02 has 65536 steps or points of resolution which must be converted into meaningful code. The process by which IEEE-488 code is generated is graphically depicted in Diagram 1.

Following is an explanation of the 3 sections of the diagram:

A. CONVERT DESIRED FREQUENCY TO DECIMAL FORMAT

65,536 points of resolution are available with the HEX-CODE 0000 to FFFF and represent 0.30518 MHz/Code.

Fo = desired frequency (MHz)

I4 = calculation variable

General Equation:

$$I4 = INT\left(\frac{Fo}{0.30518}\right)$$

I4 is a decimal number which represents the code for the desired frequency.

B. DECIMAL TO HEX CONVERSION

Since the 488-system in the unit uses 16 Bit binary it is necessary to convert the decimal number into Hex-Code. The I/O ROM in the HP-85 allows base conversion functions but because of the string size restriction, the string has to be divided for conversion.

I5	=	INT (I4/256)	Integer representing first 2 characters of final 4 - character string.
I6	=	I4 - (I5 * 256)	Integer representing last 2 characters of final 4 - character string.
I5$	=	DTH$(I5)	Decimal to hex conversion
I5$	=	I5$[3,4]	Select substring (3rd and 4th character of string)
I6$	=	DTH$(I6)	Decimal to hex conversion
I6$	=	I6$[3,4]	Select substring (3rd and 4th character of string)
I7$	=	I5$ & I6$	Assemble final hex string

C. CONVERT HEX-TUNING CODE TO TRANSMISSION CODE

The HEX-code can be converted to Transmission code with the "CONVERT" command of the HP-85 - I/O ROM. See Table 3 for the allowable Transmission Code (DATA).

P1$ = " A : B ; C < D = E > F ? "	P1$ represents the conversion table.
CONVERT out 7 pairs ; P1$	Convert statement acts on interface at select code 7 and uses P1$-conversion table.
OUTPUT 705 ; I7$	Regular output statement to send data I7$ to address 05
CONVERT out 7	Turns off the convert function.

After the completion of step "C" in the conversion process I7$ contains the proper frequency information made up of 4 data characters "DDDD".

2.4.4 ALLOWABLE INSTRUMENT CODES (TMF-1800H AND J)

The code required on the IEEE-488 Bus is a 7 character string in the following form: "DDDDABC". If more than 7 characters are sent the Option-02 will ignore the remaining characters. (Data reading is from left to right) The data code "DDDD" is explained in section 2.4.3.

A: POSITIVE FREQUENCY OFFSET

When "A" = 1,3,5,7,9,B,D, or F, then the positive frequency drive is selected. (Used for direct filter drive or for positive frequency offset). When "A" = 0,2,4,6,8,A,C, or E, then the drive is disabled.

B: NEGATIVE FREQUENCY OFFSET

When "B" = 1,3,5,7,9,B,D, or F, then the negative frequency offset is selected. (Used with the analog input drive signal to set-up a negative offset, lower frequency). When "B" = 0,2,4,6,8,A,C, or E, then the negative offset drive is disabled.

C: ANALOG INPUT DISABLE

When "C" = 1,3,5,7,9,B,D, or F, then the analog input drive voltage (1V/GHz or 0.5 V/GHz) is disconnected. (Used when only IEEE-488 bus control is desired). When "C" = 0,2,4,6,8,A,C, or E, then the applied analog input voltage (1 V/GHz or 0.5 V/GHz) drives the YIG-filter.

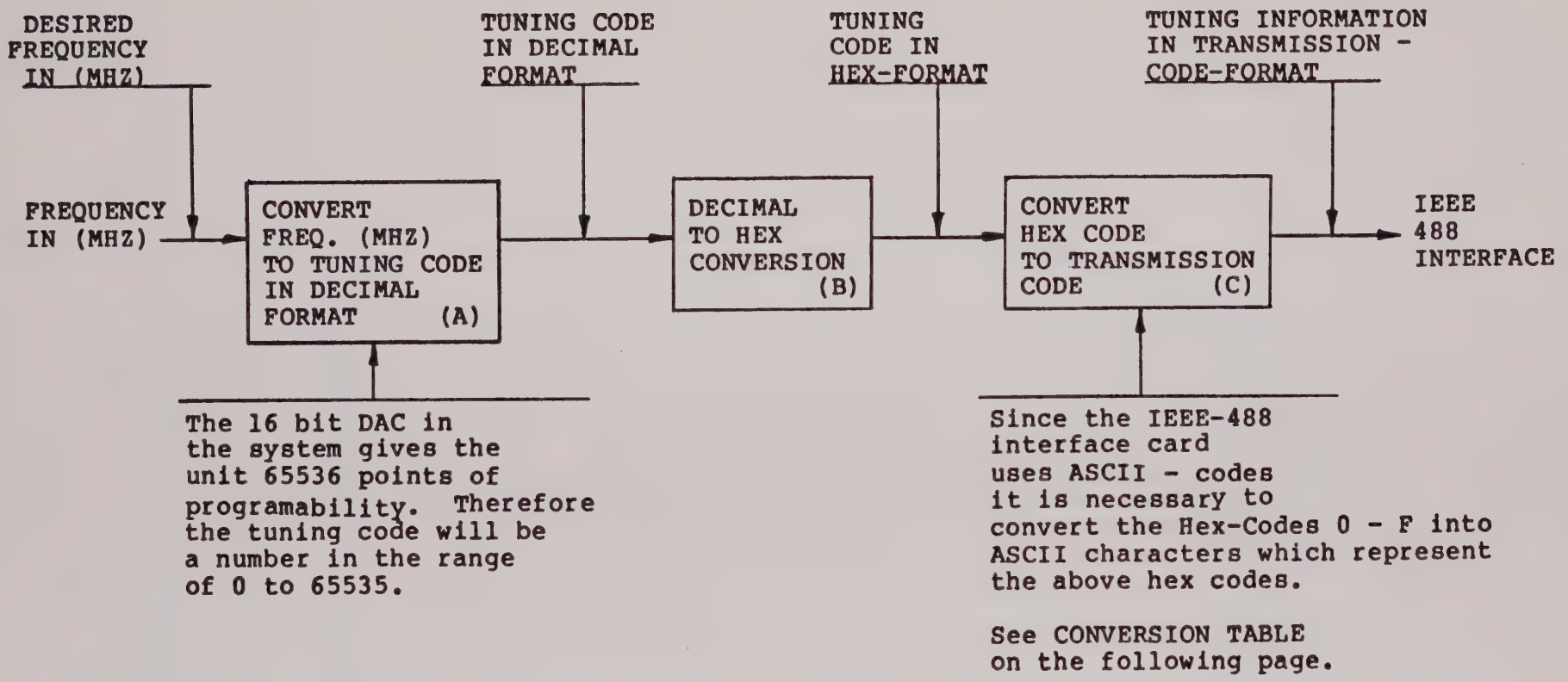

DESIRED FREQUENCY IN (MHZ)
TUNING CODE IN DECIMAL FORMAT
TUNING CODE IN HEX-FORMAT
TUNING INFORMATION IN TRANSMISSION - CODE-FORMAT
FREQUENCY IN (MHZ)
CONVERT FREQ. (MHZ) TO TUNING CODE IN DECIMAL FORMAT (A)
DECIMAL TO HEX CONVERSION (B)
CONVERT HEX CODE TO TRANSMISSION CODE (C)
IEEE 488 INTERFACE
The 16 bit DAC in the system gives the unit 65536 points of programability. Therefore the tuning code will be a number in the range of 0 to 65535.
Since the IEEE-488 interface card uses ASCII - codes it is necessary to convert the Hex-Codes 0 - F into ASCII characters which represent the above hex codes.
See CONVERSION TABLE on the following page.

DIAGRAM 1 CODE SELECTION PROCESS

codes tmf k&m/P4

CONVERSION TABLE

HEX-CODE	TRANSMISSION CODE
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
A	:
B	;
C	<
D	=
E	>
F	?

TABLE 3 TRANSMISSION CODE

2.4.5 PROGRAMMING COMMAND EXAMPLE

Assume the following conditions:

1) Desired frequency of 10.00 GHz.
2) Front panel controls inactive.
3) Analog input disabled.

A) Set Dip switch S1 to S5 in the open position (disconnect line voltage before removing top cover to set switches)!

B) With the above information carry out the code conversions described in section 2.4.3.

$$I4 = INT\left(\frac{10{,}000}{0.30518}\right) = 32{,}767$$

I5 = 127

I6 = 255

I5$ = 007F

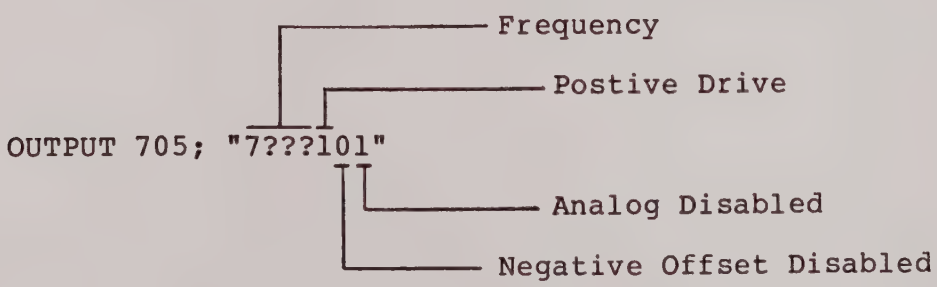
I6$ = 00FF

The HEX code for 10.00 GHz is : I7$ = 7FFF

Now use Table 3 to convert the HEX code to transmission code by direct substitution.

I7$ = "7???"

Last add the mode information. The final command with data is:



Before sending the output statement set the TMF-1800 up accordingly.

* Connect unit the HP-85
* Set the ADDRESS
* Turn on POWER
* Send the COMMAND

The TMF-1800 should respond to a tuned frequency of 10.00 GHz.

2.4.6 LISTEN ADDRESS CODES

In a 488 system, the TMF-1800 Option-02 functions as a Listener. A listener is a device capable only of receiving data or commands from other insturments. The TMF-1800 is enabled as a listener when the controller transmits the correct listen address code. The TMF-1800 interface ignores all commands or addresses relating to talkers or controllers.

The seven-bit codes reserved for listen addresses and the corresponding ASCII character are listed in Table 4. (A total of 31 addresses are available) Bits one through five of the data (DIO) lines are set either high or low to select the address. The address code is set with five address switches (Figure 4) on the rear panel. An open contact (off position) indicates a true state.

The nominal TMF-1800 listen address is ASCII Character "05". The address may be changed by the system designer since the TMF-1800 does not require any particular address. When changing addresses, be sure the new address does not conflict with those of other instruments using the 488 Bus (Refer to Table 4).

After changing the address, turn unit OFF and ON again to properly initialize the 488-card.

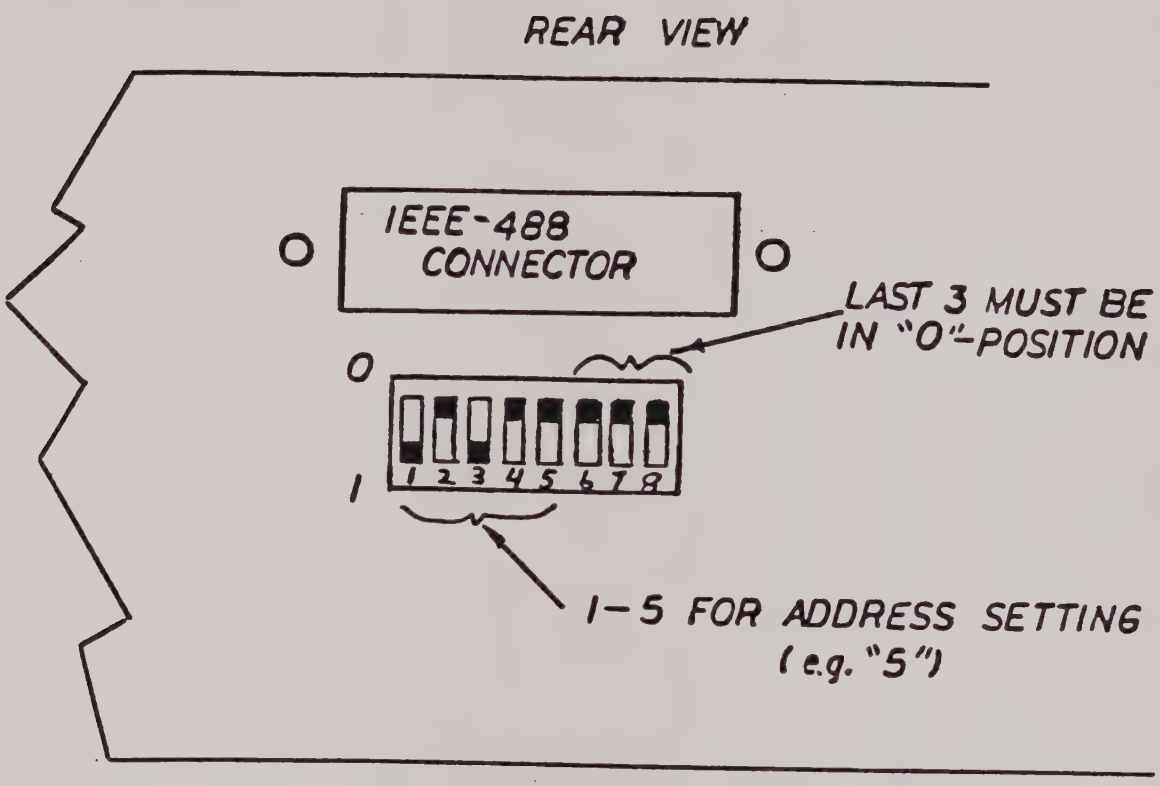


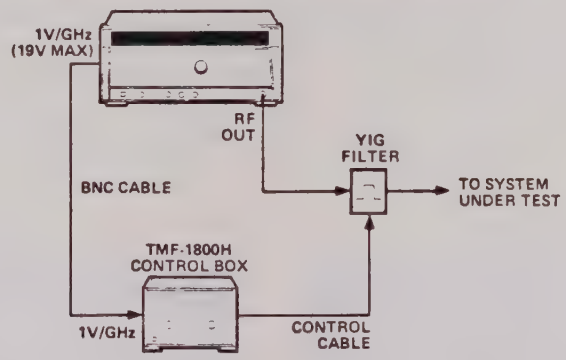
FIGURE 4 BUS CONNECTION

Address Switch Numbers					Address Characters		Octal Value	Decimal Value
5	4	3	2	1	Talk	Listen		
0	0	0	0	0	@	SP	00	00
0	0	0	0	1	A	!	01	01
0	0	0	1	0	B	"	02	02
0	0	0	1	1	C	#	03	03
0	0	1	0	0	D	$	04	04
0	0	1	0	1	E	%	05	05
0	0	1	1	0	F	&	06	06
0	0	1	1	1	G	'	07	07
0	1	0	0	0	H	(	10	08
0	1	0	0	1	I	)	11	09
0	1	0	1	0	J	*	12	10
0	1	0	1	1	K	+	13	11
0	1	1	0	0	L	,	14	12
0	1	1	0	1	M	–	15	13
0	1	1	1	0	N	.	16	14
0	1	1	1	1	O	/	17	15
1	0	0	0	0	P	0	20	16
1	0	0	0	1	Q	1	21	17
1	0	0	1	0	R	2	22	18
1	0	0	1	1	S	3	23	19
1	0	1	0	0	T	4	24	20
1	0	1	0	1	U	5	25	21
1	0	1	1	0	V	6	26	22
1	0	1	1	1	W	7	27	23
1	1	0	0	0	X	8	30	24
1	1	0	0	1	Y	9	31	25
1	1	0	1	0	Z	:	32	26
1	1	0	1	1	[	;	33	27
1	1	1	0	0	\	<	34	28
1	1	1	0	1	]	=	35	29
1	1	1	1	0	^	}	36	30
1	1	1	1	1	—	?	37	31

TABLE 4 IEEE-488 ADDRESS CODES

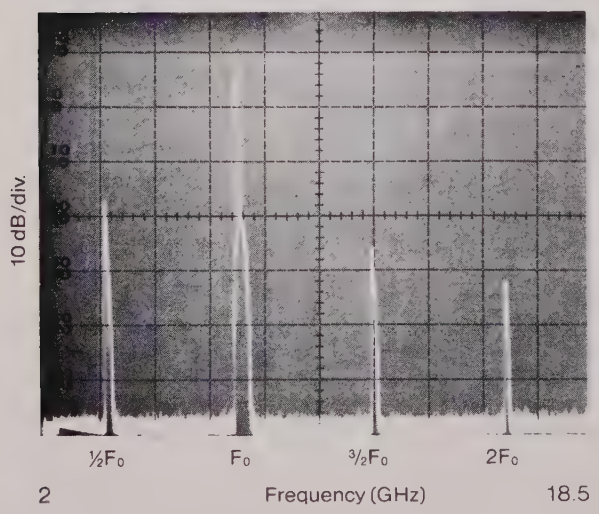
2.5 Typical Applications

2.5.1 Reduce Harmonics on Microwave Sweeper Output

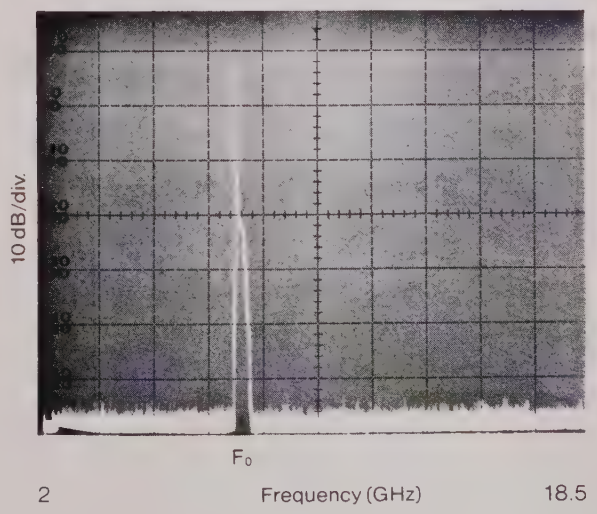


The INTEGRA Tunable Microwave Filter Model TMF-1800H can reduce harmonics and spurious output signals on Microwave Sweepers, synthesizers and signal generators by an additional 30 db. This can improve most sweepers to a harmonic level of -55 to -70 dBc.

WITHOUT Tracking Filter



WITH Tracking Filter

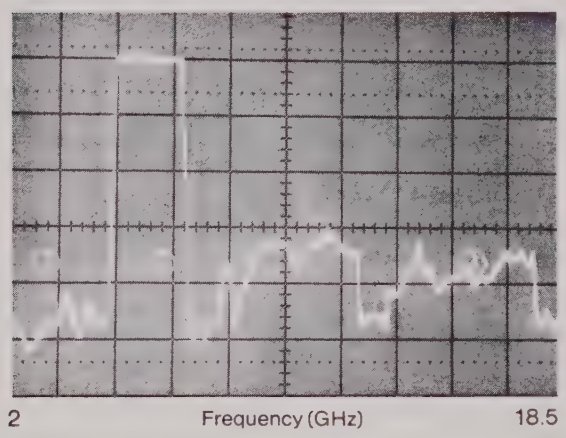


2.5.2 Microwave Filter Measurements

To measure off-resonance isolation (ORI) of a filter, over a wide frequency range, a very clean signal source is required. The dynamic range of the ORI measurement is limited by the Harmonic and Spurious output levels of the signal generator. Many signal sources contain harmonics that are only 25 to 30 dB below the carrier. The TMF-1800H is an Automatic Frequency Tracking Filter that reduces harmonics to a level of 50 to 60 dB below the carrier.

Exhibit A illustrates the effects of both subharmonic and high order harmonics on the ORI measurement of a 6.5 GHz bandpass filter. Exhibit B illustrates the true response of this filter.

EXHIBIT A



① Harmonic Response
② True Filter Response
③ Sub-Harmonic Response

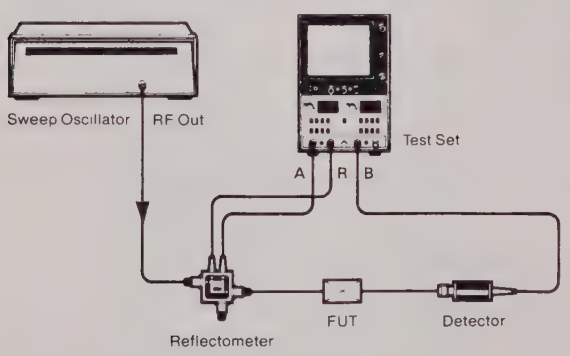
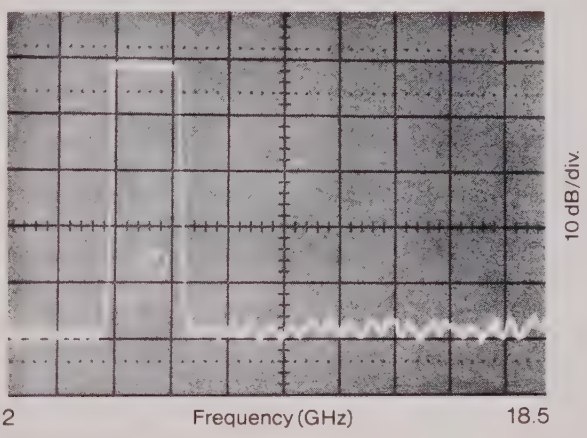
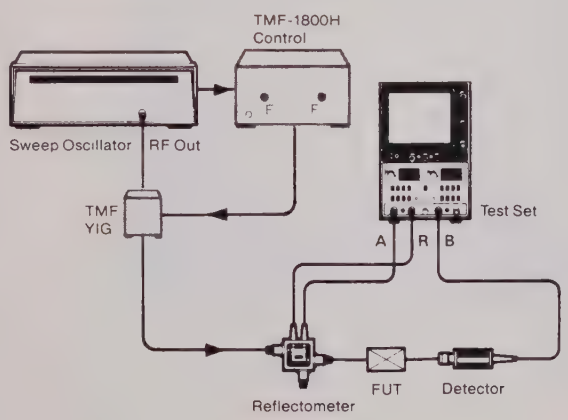


EXHIBIT B



② True Filter Response



HEWLETT PACKARD

PRODUCT NOTE NO. **8340A-6**

REDUCED HARMONIC DISTORTION USING THE INTEGRA TMF-1800H TRACKING FILTER WITH THE HP 8340A SYNTHESIZED SWEEPER

Distortion resulting from harmonically related spurious signals is present to some extent in all signal sources. This distortion can take the form of harmonics or subharmonics. Harmonics of a desired RF output (F_O) are found at frequencies which are integer multiples ($2F_O$, $3F_O$, etc.) of the desired RF output. Similarly, subharmonics exist at frequencies which are fractional multiples ($1/2F_O$, $2/3F_O$, $3/2F_O$, etc.) of the desired RF output frequency and are found in multiplier based sources. The actual magnitude of any one source harmonic will vary depending on the output power level and the specific order (multiple) of the harmonic.

The HP 8340A Synthesized Sweeper, for example, specifies a low level of harmonic distortion, with harmonics of <-35 dBc and subharmonics <-25 dBc (<-20 dBc subharmonics from 20-26.5 GHz), across its very broad 10 MHz to 26.5 GHz frequency range. However, if greater source harmonic rejection is necessary, for example in measuring the rejection band of a filter, a tuned microwave receiver like the HP 8410 Network Analyzer can be used. In other component or signal simulation tests, rigorous external filtering of the RF output may be required to achieve the desired level of low harmonic distortion. One of the most effective and convenient external filtering techniques is to use a broadband tracking microwave filter. This product note will describe the source harmonic performance, the equipment setup and the operation associated with using the Integra TMF-1800H Tunable Microwave Filter* with the HP 8340A Synthesized Sweeper.

INTEGRA TMF-1800H TUNABLE MICROWAVE FILTER

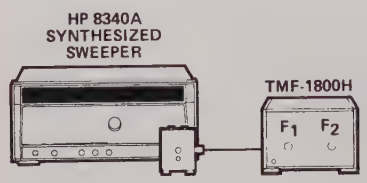


Figure 1: TMF-1800H Filter connects easily to the RF output of the HP 8340A Synthesized Sweeper.

The TMF-1800H consists of a control box and a single stage yitrium-iron garnet (YIG) filter (see Figure 1) designed to track across a 2-18.5 GHz frequency range with less than 3 dB of insertion loss and a 3 dB bandwidth of typically 45 MHz (See Appendix A and Figures 2 and 3 for more details).

*Integra Microwave
A Division of INTEGRA, Inc.
2368 Walsh Avenue, Santa Clara, CA 95051

Telephone (408) 727-9601/TWX: 910-338-0585

All inquiries regarding performance specifications, warranties and ordering procedures for the Integra TMF-1800H should be directed to Integra.

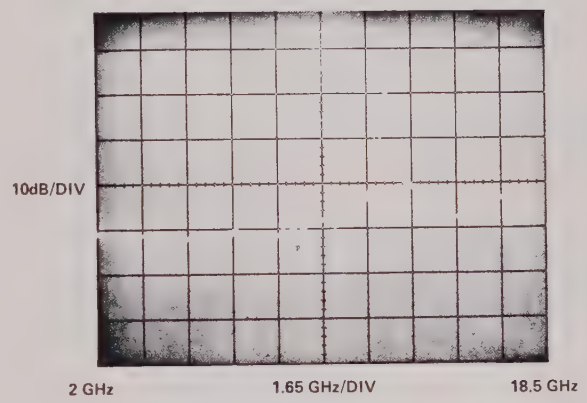


Figure 2: Frequency response of TMF-1800H Filter tuned to F_O=12.4 GHz. Note: 25 to 35 dB off resonance isolation.

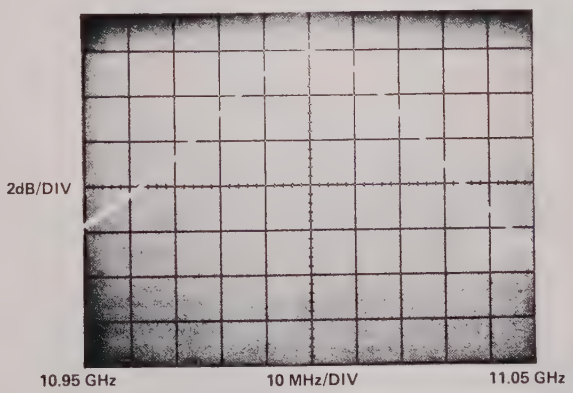


Figure 3: Band pass filter response of TMF-1800H Filter tuned to F_O=11 GHz. Note: Typical 3 dB band width of 45 MHz.

The center frequency of the TMF-1800H is automatically tuned to track the RF output of the HP 8340A Synthesized Sweeper via the 1V/GHz frequency reference voltage available on the rear panel of the HP 8340A. This way the filter is easily and conveniently tuned to the desired RF test signal and adds 20 dB to 30 dB of rejection to all spurious signals outside the passband (See Figure 4, 5, 6 and 7).

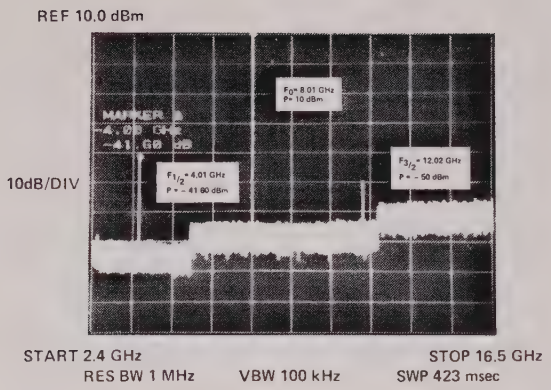


Figure 4: HP 8340A Synthesized Sweeper RF output spectrum as seen on HP 8566 Spectrum Analyzer. Note: Harmonics are 41.60 dBc and subharmonics are 50 dBc.

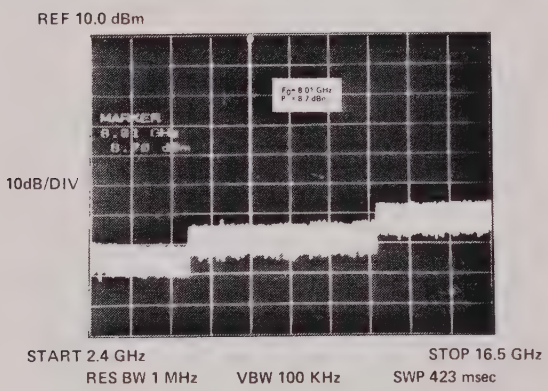


Figure 5: HP 8340A Synthesized Sweeper RF output using the TMF-1800H Filter as seen on HP 8566 Spectrum Analyzer. Note: Harmonics and subharmonics are 60 dBc.

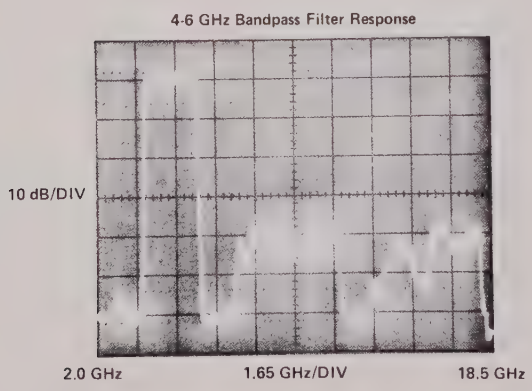


Figure 6: 2-18.5 GHz Swept RF output of HP 8340A Synthesized Sweeper as shown on HP 8755 Network Analyzer. Note: Harmonics are 55 dBc and subharmonics are 35 dBc.

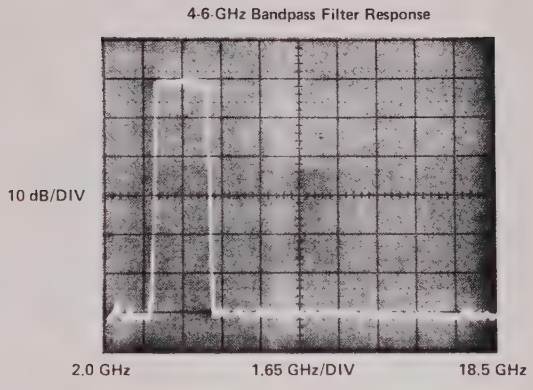


Figure 7: 2-18.5 Swept RF output of HP 8340A Synthesized Sweeper using TMF-1800H Filter as shown by HP 8755 Network Analyzer. Note: Harmonics and subharmonics are 60 dBc.

Another model, the Integra TMF-1800C, can be used to obtain similar results; however, the TMF-1800C is tuned either manually by front panel adjustments or remotely by Hewlett-Packard Interface Bus (HP-IB)** program commands. Its major application is in CW operations where independent control of the filter is desired. Appendix B discusses the TMF-1800C operation.

SETUP AND TYPICAL PERFORMANCE (2-18.5 GHz)

The TMF-1800H filter can be configured with the HP 8340A Synthesized Sweeper in several ways allowing the user to select the setup and performance which best meets his measurement needs. Figure 8 and 9 show two recommended configurations.

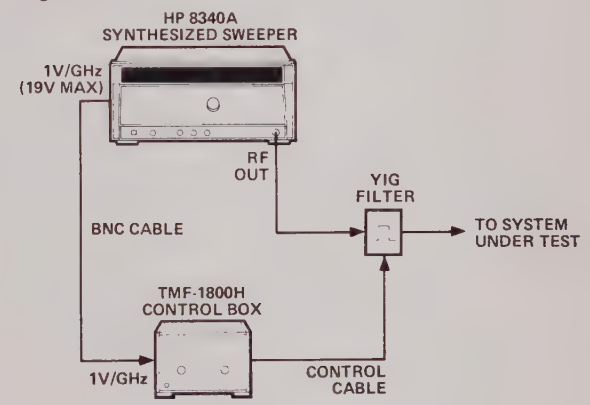


Figure 8: Setup for internally leveled CW or swept operations using TMF-1800H Filter with HP 8340A Synthesized Sweeper.

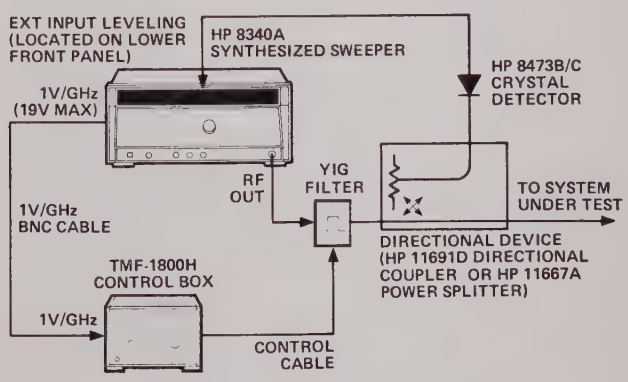


Figure 9: Setup for externally leveled CW or swept operations using TMF-1800H with HP 8340A Synthesized Sweeper.

**HP-IB is Hewlett-Packard's hardware, software, documentation and support for IEEE-488 and IEC-625, worldwide standards for interfacing instruments.

Table 1: Typical Performance*
When TMF-1800H is Combined With HP 8340A

Setup	Spurious Outputs	Frequency Range	Insertion Loss	CW Step*** Time Minimum	Sweep Time Minimum	Power** Flatness
Figure 8	50-60dBc	2-18.5GHz	3 dB	0.4msec/GHz Step	16msec/GHz	±1.5 dB
Figure 9	50-60dBc	2-18.5GHz	3 dB	0.4msec/GHz Step	8msec/GHz	±1 dB

*For more information see HP 8340A Data Sheet and Appendix A (TMF-1800H)
**Conditional upon HP 8340A being in an externally (Figure 9) or internally (Figure 8) leveled state. HP 11667A Power Splitter and HP 11691D Directional Coupler are recommended for External Leveling.
***TMF-1800H **only**

ADJUSTMENT PROCEDURE OF OPERATION

Once it has been configured and warmed up for 1 hour, the system needs to be roughly adjusted for basic CW performance or finely adjusted for maximum performance in CW and swept operations.

Basic alignment of the filter to the HP 8340A is done by following the General Adjustment Procedure listed below:

GENERAL ADJUSTMENT PROCEDURE (for basic CW operation)

1. On the HP 8340A press: **INSTR PRESET**
2. On the HP 8340A press: **CW 2 GHz**
3. Adjust F_1 of the TMF-1800H to a point of minimum insertion loss (maximum power) using a power meter, an HP 8755 Scalar Network Analyzer or an oscilloscope with a diode detector to monitor the RF output. If the HP 8755 is used, be sure to connect the 27.8 kHz square wave modulator drive of the HP 8755 to the pulse input of the HP 8340A and press **PULSE** on the HP 8340A.
4. On the HP 8340A press: **CW 1 8 . 5 GHz**
5. Adjust F_2 of the TMF-1800H to a point of minimum insertion loss

This way the lower (F_1) and upper (F_2) end points (2 to 18.5V) of the 1V/GHz input for the TMF-1800H are adjusted to align with the end points of the 1V/GHz frequency reference voltage output for the HP 8340A.

Upon completing this General Procedure, the TMF-1800H will automatically track any CW frequency entered or programmed on the HP 8340A. The following specific procedures will enable maximum performance for any particular case. The CW Adjustment Procedure can typically decrease the filter insertion loss by 0.5 dB. The Internally and Externally Leveled Swept Adjustment Procedures, however, must be followed for all swept operations.

CW ADJUSTMENT PROCEDURE (for maximum CW operation)

Single CW Frequency:

1. Set HP 8340A for desired CW frequency (2-18.5 GHz):
   CW , "Desired Frequency" , **GHz**
2. Set HP 8340A for desired power output:
   POWER LEVEL , "Desired Power" , **dBm**
3. Carefully adjust F_1 if the desired CW frequency is below 10 GHz or adjust F_2 if the desired CW frequency is above 10 GHz. Selecting the proper end point, F_1 or F_2, will provide the best results with a minimum of adjustment. Fine tune the proper end point until a minimum insertion loss point is achieved.

To check or change the CW settings simply repeat steps 1 through 3 of the Single CW Frequency procedure.

Stepped CW Between a START and STOP Frequency:

Basically perform the same steps as for a single CW frequency except adjust F_1 for the stepped CW "START" frequency and F_2 for the stepped CW "STOP" frequency. (See TABLE 1 for minimum step time).

In order to change or check the conditions of a Stepped CW operation, repeat the procedure mentioned above.

INTERNALLY LEVELED SWEPT ADJUSTMENT PROCEDURE (for all internally leveled swept operations)

The HP 8755 Network Analyzer or an oscilloscope with a diode detector is required to monitor the RF output during this procedure.

1. Prepare the HP 8340A for swept, tracking filter operations
   a. On the HP 8340A press: **INSTR PRESET, SHIFT, MHz, 1, 2, Hz, SHIFT, kHz, 2, 2, Hz**
   b. On the HP 8340A, hold down the step up key until Calibration Constant #58 appears in the "Entry Display"
   c. Record this value for future reference.
   d. On the HP 8340A press: **4, Hz, ENTRY OFF**

   NOTE: Steps 1 a, b and c change Calibration Constant #58 from its previous setting and allows the TMF-1800H to operate with the HP 8340A by causing a delay of 40 msec after each frequency sweep retrace before beginning the next frequency sweep. When the TMF-1800H is not being used, Calibration Constant #58 should be restored to its original value by following steps 1 a, b, c and replacing the value 4 in step d with the previous value. See the underside of the top cover of the 8340A for the initial factory preset value of all Calibration Constants including #58.

2. Enter the desired swept START frequency on the HP 8340A:
   START FREQ, "Desired Frequency", **GHz**
3. Enter the desired STOP frequency on the HP 8340A:
   STOP FREQ, "Desired Frequency", **GHz**

4. Enter the desired sweep time on the HP 8340A: **SWEEPTIME**, "Desired Time", **msec**
(See Table 1 for minimum internally leveled sweep time)

5. With the **FREERUN CONTINUOUS** Sweep active on the HP 8340A, carefully adjust the TMF-1800H to optimize the insertion loss through the swept frequency range. This is done by adjusting first F_2, then F_1, and finally F_2 once again until the insertion loss is optimized. Remember the **PULSE** of the HP 8340A must be on and connected to MODULATOR DRIVE if the HP 8755 Network Analyzer is used.

Once the swept procedure has been completed, any sweep time or frequency sweep limit (within the constraints of Table 1) can be changed or checked by simply repeating steps 2 through 5.

EXTERNALLY LEVELED SWEPT ADJUSTMENT PROCEDURE (for all externally leveled swept operations)

The HP 8755 Analyzer or an oscilloscope with a diode detector is required to monitor the RF output during this procedure.

1. Follow the same procedures outlined for Internally Leveled Swept Operations. This will ensure the TMF-1800H is near its ideal F_1 and F_2 settings.

2. Enter the desired sweep time on the HP 8340A: **SWEEPTIME**, "Desired Time", **msec**
(See Table 1 for minimum Externally Leveled sweep time).

3. On the HP 8340A press **XTAL** to activate EXTERNAL LEVELING or press **METER** for POWER METER LEVELING.

   NOTE: When the system is in an External Leveling mode, the HP 8340A "Unleveled Light" will turn "On" during retrace. This is because the HP 8340A frequency retrace is much faster than the retrace of the TMF-1800H. The leveling loop cannot compensate for the increased loop attenuation (typically 30 dB) resulting from the retrace tracking errors. Before a frequency sweep begins, however, the filter and the HP 8340A re-align and normal external leveling is resumed.

4. On the HP 8340A press: **POWER LEVEL** and adjust the knob until the desired output is achieved. Remember to disregard the flashing "Unleveled Light" on the HP 8340A because of the conditions mentioned in the above note.

   NOTE: During External Leveling the HP 8340A "POWER dBm" display indicates the output power at the HP 8340A RF connector which is not necessarily the final output of the external leveling loop.

5. If oscillations appear in the CRT trace of the RF output, indicating an unleveled condition, carefully adjust F_2 of the TMF-1800H and the power level of the HP 8340A until the oscillations subside.

For further information on external crystal detector or power meter leveling, refer to Section 3 of the HP 8340A Operation and Service Manual.

In order to change or check the TMF-1800H settings, repeat the External Leveling procedures 1 through 5.

After properly adjusting the HP 8340A and the TMF-1800H according to the procedures mentioned, this system should perform as outlined in the Typical Performance Table 1.

MEASUREMENTS OUTSIDE THE RANGE OF THE TMF-1800H

Since the TMF-1800H only covers the 2-18.5 GHz portion of the 10 MHz to 26.5 GHz frequency range offered by the HP 8340A, it may be necessary to remove or by pass the filter for certain measurements. One convenient way to switch the filter in or out is to use the HP 33311C (Option C05) Coax Switch, which operates from DC to 26.5 GHz.

Push-button control of this Coax Switch with switching times of less than 10 milliseconds can be achieved using the high speed HP 11713A Switch Driver configured as shown in Figure 10.

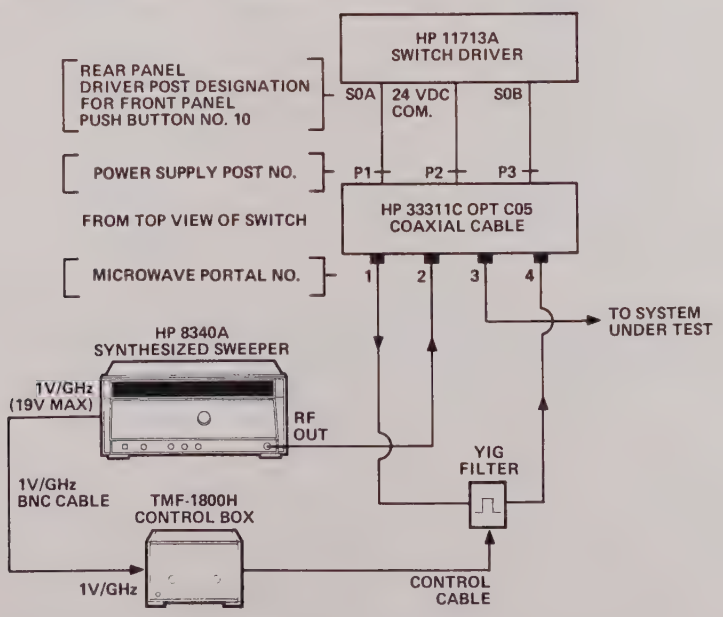


Figure 10: Automatic switch configuration using HP 33311C (Opt. C05) Coax Switch and HP 11713A Switch Driver to interact between HP 8340A Synthesized Sweeper and TMF-1800H Filter.

Since the HP 8340A Synthesized Sweeper and the HP 11713A Switch Driver are completely HP-IB programmable, the configuration in Figure 10 can be controlled remotely by way of HP-IB connections from the HP 8340A and the HP 11713A to an HP computer. With this, a simple computer program can easily and automatically coordinate the interface between the user and the system.

For example, the following short subroutine for the HP 85, HP 9826 or HP 9836 desk top computer is all that is needed to remotely operate the HP 11713A Switch Driver (provided the HP 11713A has an HP-IB address of 728; switch #10 is used; and the necessary START, STOP or CW frequencies have already been entered as F_0, F_1, and F_3).

```
100)! TMF-1800H Interface via HP 11713A
        Switch Driver Subroutine
110)  IF F0 <2 or F0 >18.5 or F1 <18.5 or F1 <2 or F2
        <2 or F2 >18.5 then output 728; "A0"
120)  IF F0 > =2 and F0 < =18.5 and F1 <=18.5 and F1
        > =2 and F2 > =2 and F2 < =18.5 then output
        728; "B0"
130)  RETURN
```

For more detailed information regarding the performance specifications of the HP 8340A Synthesized Sweeper, the HP 33311C (Option C05) Microwave Coax Switch or the HP 11713A Switch Driver, please refer to their respective Operating and Service Manuals, Data Sheets or HP-IB Programming Notes.

All inquiries regarding performance specifications, warranties and ordering procedures for the Integra TMF-1800H should be directed to the Integra Microwave Company.[3]

[3] INTEGRA, Inc.
2368 Walsh Avenue, Santa Clara, CA 95051
Telephone: (408) 727-9601/TWX:910-338-0585
Attention: Len Johnson

APPENDIX A:

FILTER SPECIFICATIONS

Integra Tunable Microwave Filter 1800*

Specification	TMF 1800C/H
Number of Stages	1
Frequency Range	2-18.5 GHz
Bandwidth (-3 dB)	15-70 MHz
Insertion Loss (max)	3 dB
Off Resonance Isol. (min)	30 dB
Limiting Level (min)	+10 dBm
Selectivity (nom)	6 dB/Octave
VSWR (typ)	2 : 1
Impedance (nom)	50 Ohms
Max. Input Power	+30 dBm
Connectors	SMA Jack (3mm)
Size (WxHxL)	3" x 3" x 4"

*Note: Specifications listed above were obtained from the Intregra data sheet and are subject to change without notice.

APPENDIX B:

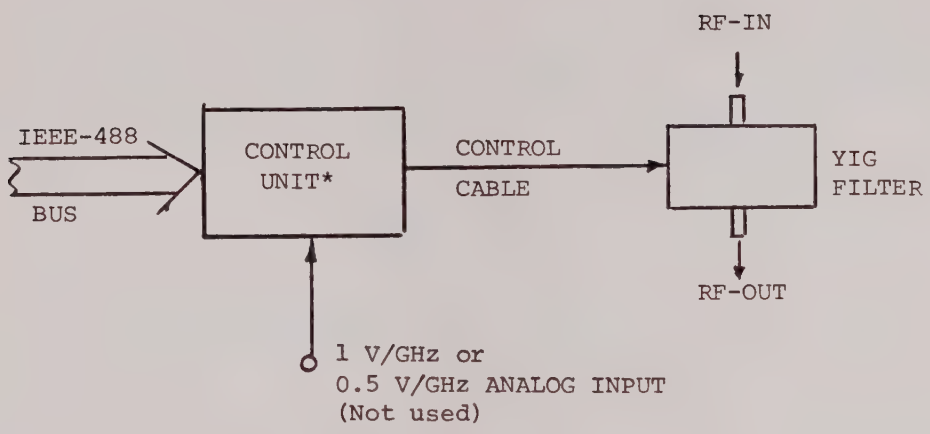
CW MODE HP-IB CONTROL OF TMF-1800C

This is for independent HP-IB Control of the Integra TMF-1800C using an HP 85, HP 9826 or HP 9836 Desktop Computer. This subroutine assumes the desired CW frequency has been previously entered as F0 and the TMF-1800C has an HP-IB address of 705.

```
100)! HP-IB Control of CW frequency Setting for TMF-1800C
110)  F1=2                              !  Initialize filter limits
120)  F2=18.5
130)  P=INT((F0-F1)/(F2-F1)*9999)       ! Calculate which point to
                                          use from a possible 9999
                                          points
140)  P=(P+10000)*1000+10               ! Combine Band limit and
                                          capacitor information
150)  P$=VAL$(P)                        ! Create output command string
160)  P$=P$[2,8]
170)  OUTPUT 705;P$                     ! Output command to Filter
180)  RETURN
```

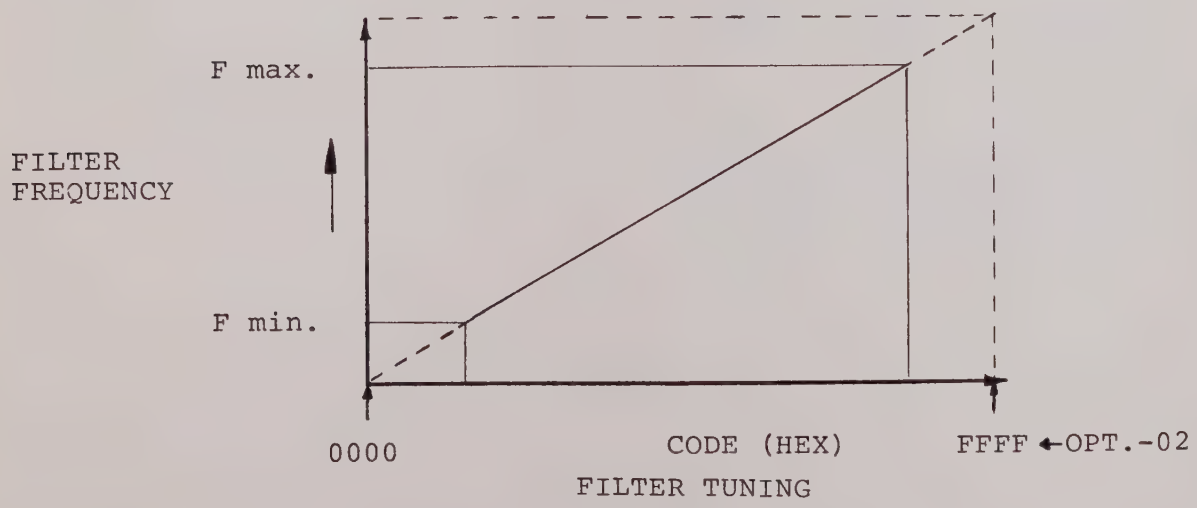
The CW subroutine programming time is approximately 60 msec to tune from 2 to 18.5 GHz and 80 msec to tune from 18.5 to 2 GHz. This time period includes the HP-IB response time. For further details refer to the Integra TMF 1800C Operation and Service Manual.

2.5.4 IEEE-488 Controlled Filter



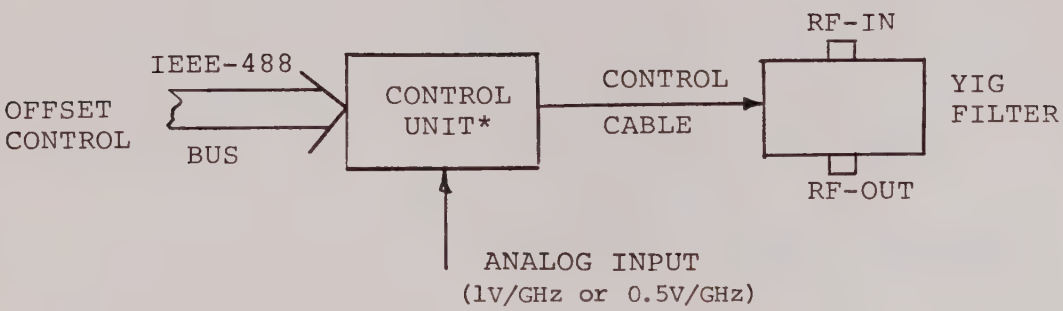
*CONTROL UNIT WITH IEEE-488 OPTION

The Tunable Microwave Filter TMF-1800H (with Option-02) can be controlled by the IEEE-488 Bus with .30518 MHz/Code points resolution across the frequency range of the filter. If desired the F1-offset control can be used by selecting the desired DIP-switches inside the control unit (See Table 1 for ranges). The gain control F2 is not active in this mode and the analog input should be disconnected by choosing the proper control code.



FILTER TUNING

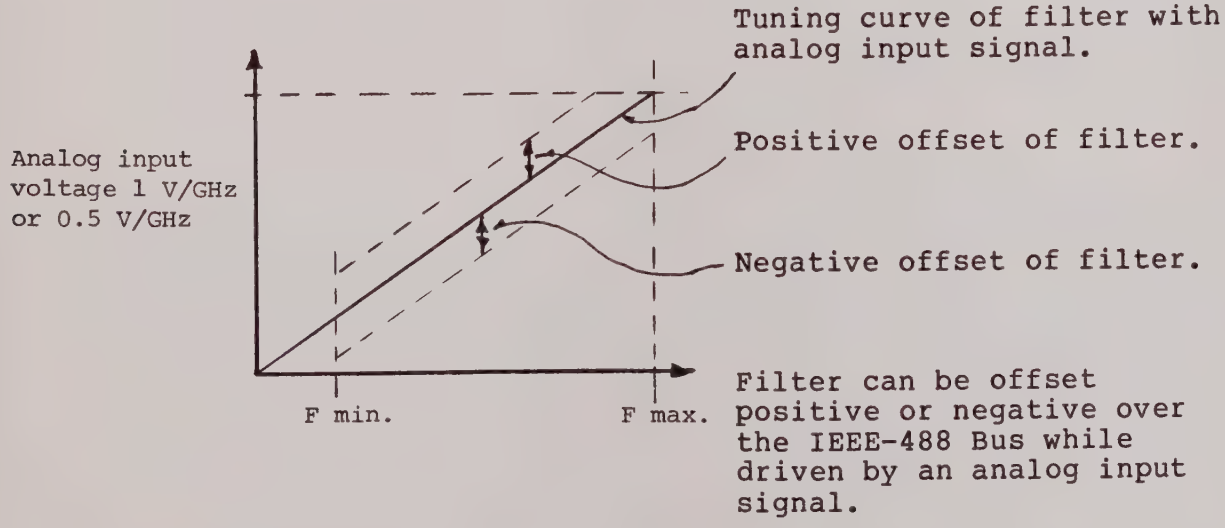
2.5.5 Analog Tracking With Digital Offset Control



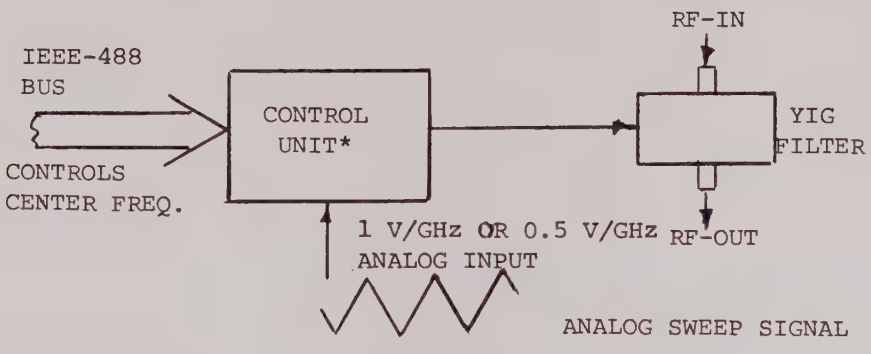
TRACKING FILTER WITH OFFSET

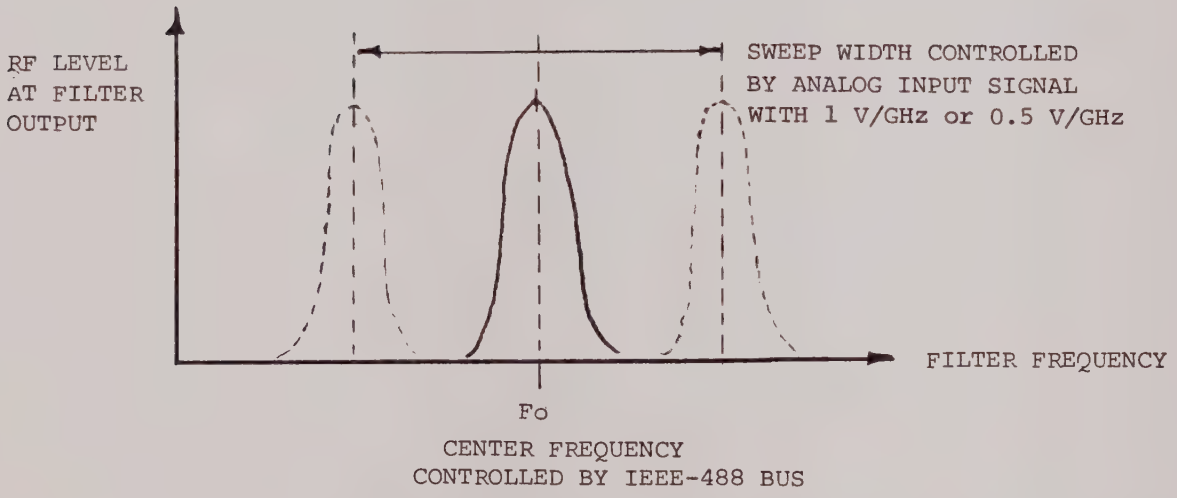
In this mode the F1 and F2 controls are used to set-up the filter tracking with the analog input voltage and the digital offset is superimposed over the analog drive.

Typical applications are mixer testing, up-converters, down-converters, noise figure measurements.


Tuning curve of filter with analog input signal.
Positive offset of filter.
Negative offset of filter.
Analog input voltage 1 V/GHz or 0.5 V/GHz
F min.
F max.
Filter can be offset positive or negative over the IEEE-488 Bus while driven by an analog input signal.

2.5.6 Sweeping Filter With Digital Center Frequency Control





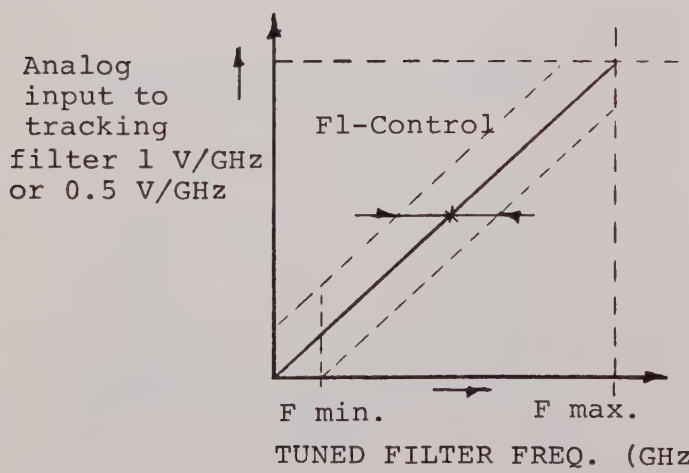
F1 and F2 controls can be used as required by selecting the appropriate Dip-Switches inside the control unit.

Typical Applications: Spectrum monitoring on oscilloscope, power measurements ect. (See application section).

3.0 THEORY OF OPERATION

3.1 System Operation

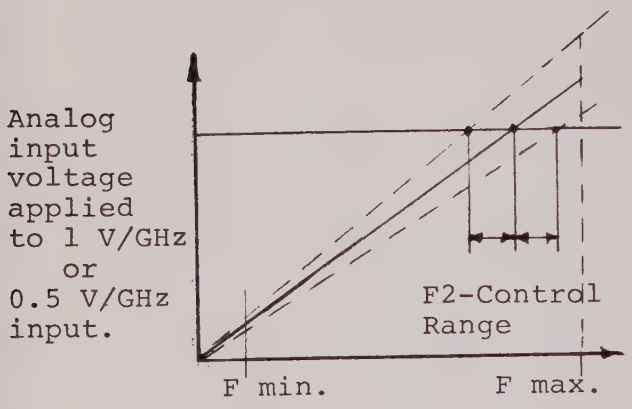
Fig. 3 is a block diagram of the INTEGRA Tunable Microwave Filter Model TMF-1800H. In the analog drive mode, an external drive signal is applied to the EXT DRIVE input. This is buffered and available at the buffered output to drive other instruments. The EXT. DRIVE SELECTOR selects the input range 1 V/GHz or 0.5 V/GHz. The drive section converts this signal to drive the YIG-filter. The F1-control provides a ± offset adjustment to compensate for small frequency "errors". This adjustment is independent of drive signal and moves the filter a fixed number of MHz (plus or minus). (See Fig. 5).



F1-control allows to offset the filter a constant amount plus or minus. This amount is controlled by F1-control (10 turn potentiometer on front panel of control unit and internal Range-selectors (Dip-switches). The Dip-switches can be controlled after removing the top cover of the TMF-1800H Control Unit.

Fig. 5 F1-Control

The F2-control is fine adjustment for the external drive signal and its effect is proportional to the drive signal (slope adjustment) (See Fig. 6).



The F2-control allows to change the gain of the filter driver and can correct if the driving signal at the input is not exactly 1.000 V/GHz or 0.500 V/GHz. The available range of F2 is a fixed percentage of the tuned filter frequency.

Fig. 6 F2-CONTROL

The YIG Filter is driven through a control cable and can be located directly in the RF-test set-up. The typical bandpass response is shown in Fig. 7, and a wide band response is shown in Fig. 8.

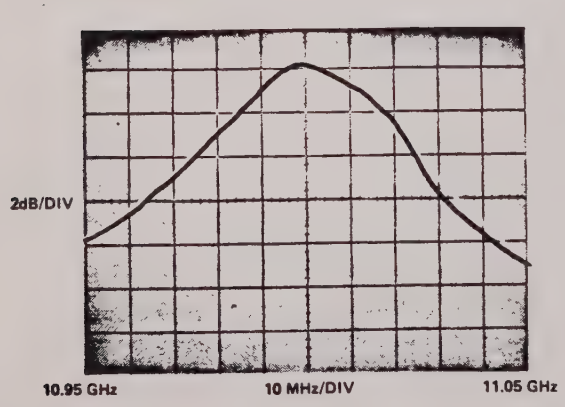


Figure 7 Band pass filter response of TMF-1800H Filter tuned to F_O=11 GHz. Note: Typical 3 dB band width of 45 MHz.

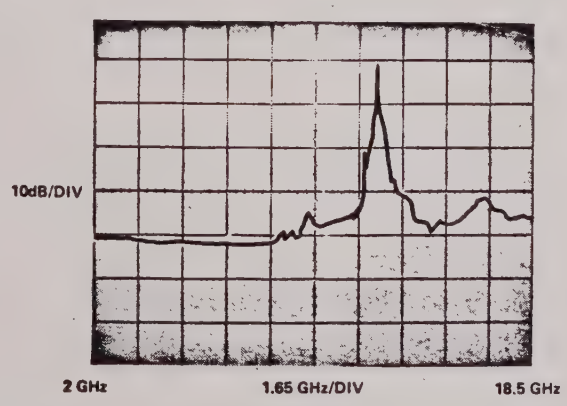


Figure 8 Frequency response of TMF-1800H Filter tuned to F_O=12.4 GHz. Note: 25 to 35 dB off resonance isolation.

The IEEE-488 Bus Control Option allows complete control over the TMF-1800H. The unit can be controlled with 65536 points resolution over the frequency range. This gives a frequency resolution of .30518 MHz/Code. The bus can also control relay A, B, and C. Relay A controls the positive drive. Relay B controls the negative frequency drive (used for negative offset, when the unit also uses the EXT. DRIVE INPUT). The Relay C allows to disconnect the EXT. INPUT DRIVE when only IEEE-488 bus control is desired.

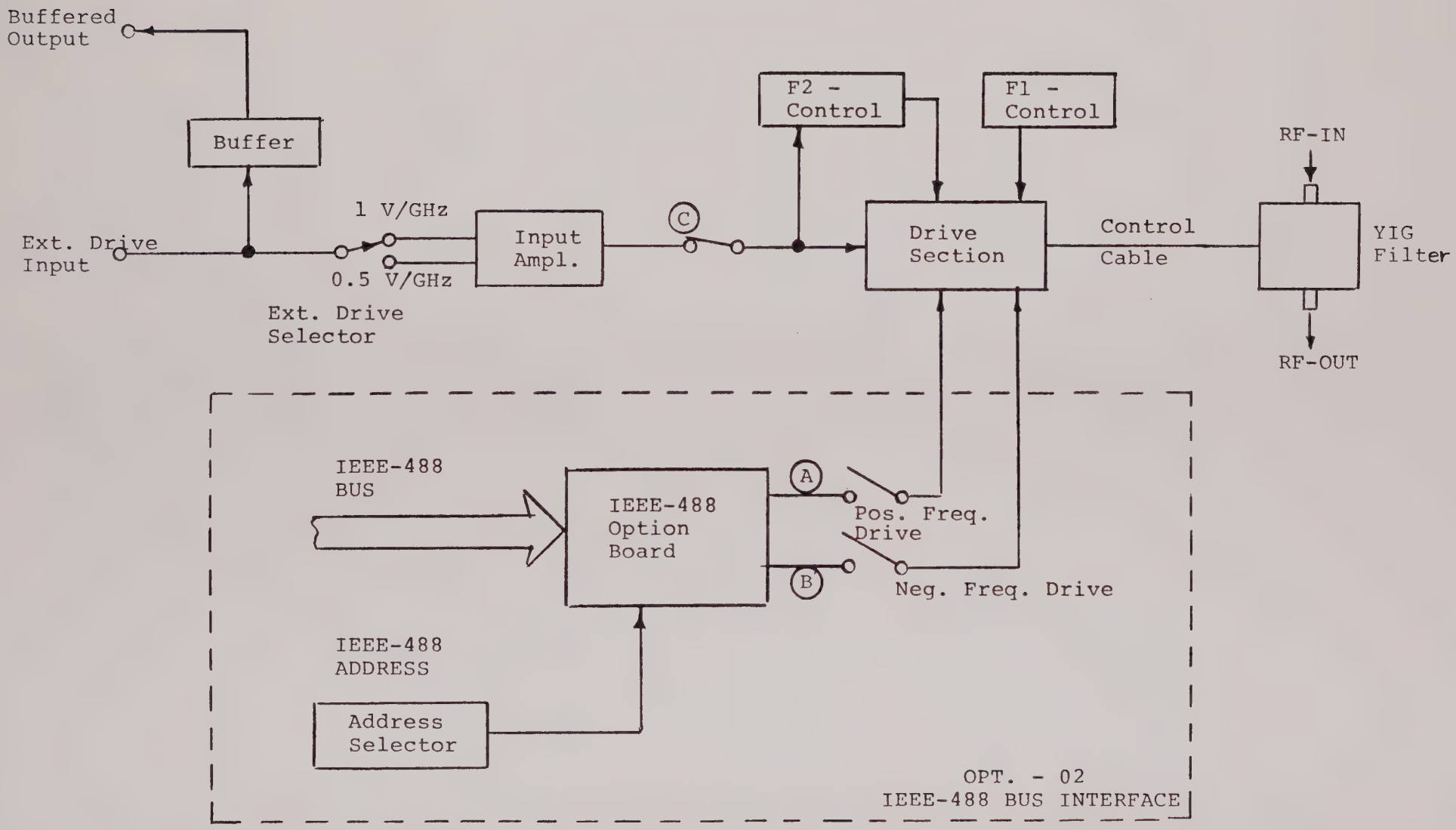


Fig. 3 TMF-Block Diagram

4.0 TMF-1800H CALIBRATION PROCEDURE

The Internal Voltage Calibration procedure section 4.1 and the IEEE-488 Calibration section 4.3 are only used after replacement of potentiometers, operational amplifiers or other parts on the main board or the IEEE-488 Interface Board. The routine Frequency Calibration is covered in Section 4.2 FREQUENCY CALIBRATION. Routine Frequency Calibrations should be performed every 6 months.

4.1 Internal Voltage Calibration

Connect equipment as shown in Fig. 9. Install 16 pin test adapter in sockets CH1, CH2 and CH3 located on the Control Unit mother board. Refer to Fig. 10 for location of sockets and adjustment potentiometers.

4.1.1 Apply power to equipment and allow a warm-up period of 30 minutes before proceeding.

4.1.2 Power Supply Readings: (measured with reference to CH1-2 or CH2-1)

CH1-6: +13 VDC ±10%

CH1-7: -13 VDC ±10%

CH1-1: +11 VDC ±10%

CH1-14: +15 VDC ±5%

CH1-11: -15 VDC ±5%

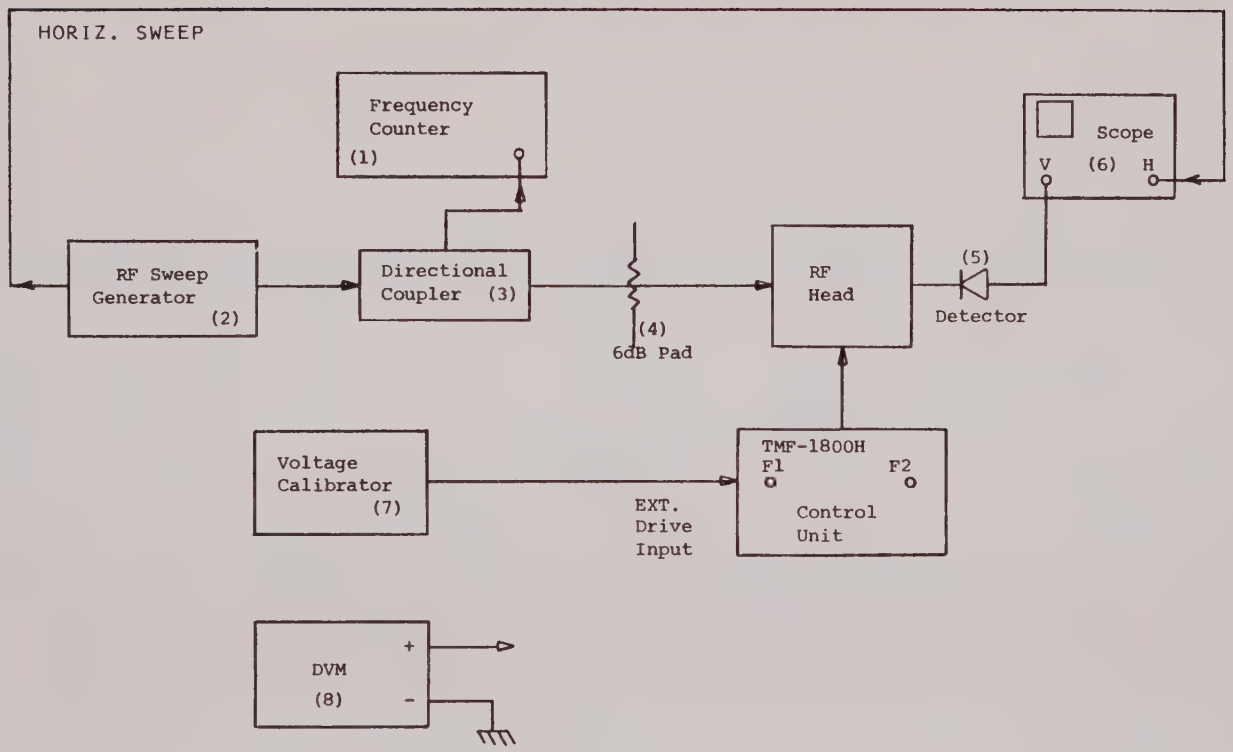
CH1-5: +5 VDC ±5%

4.1.3 Reference Voltage Adjustments

Adjust R44 for +10.000 V at CH2-13

Adjust R45 for -10.000 V at CH2-12

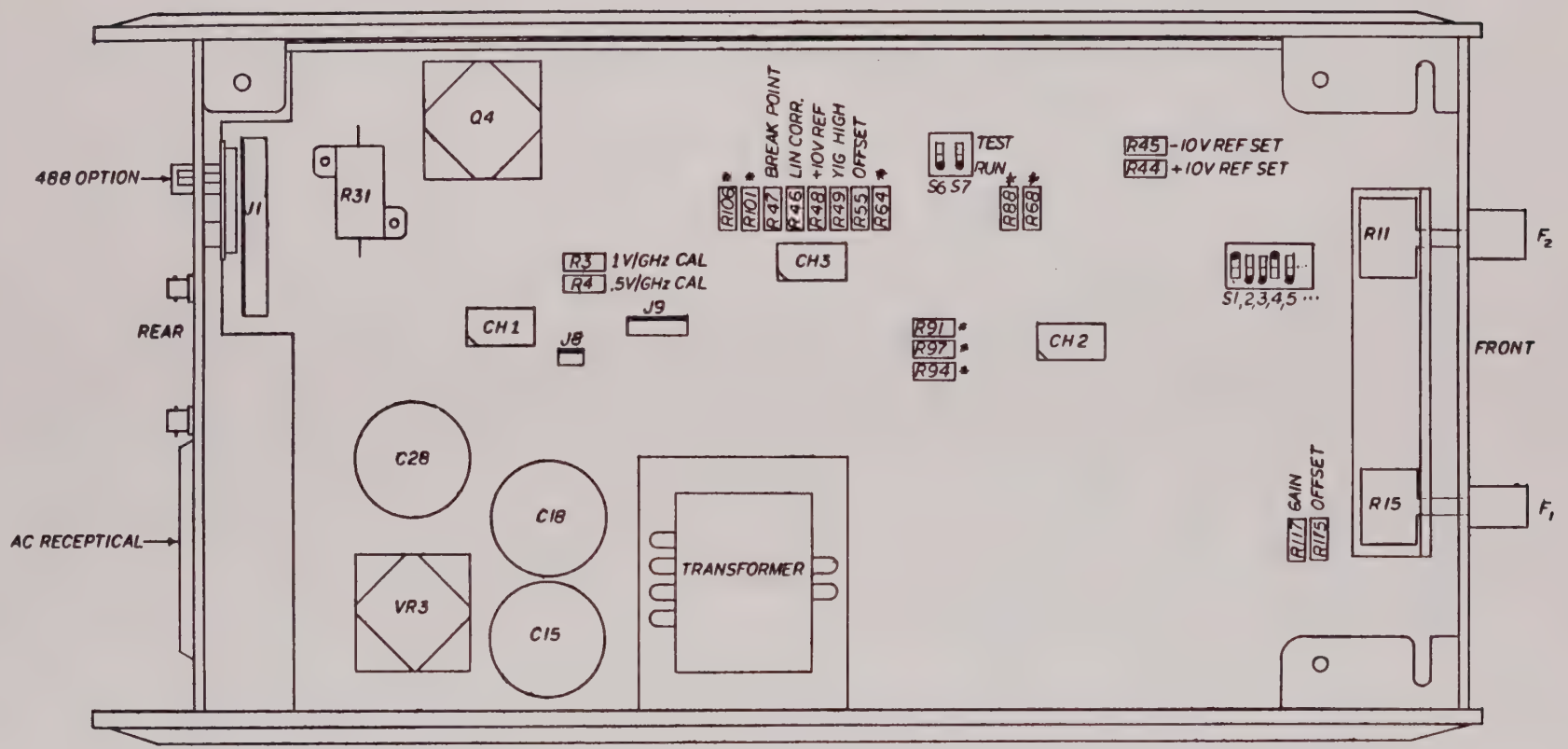
NOTE: CH1-2 & CH2-1 are chassis ground



TEST EQUIPMENT LIST

	Item	Model No.	Mfg
1.	Frequency Counter	5342A	Hewlett-Packard
2.	Microwave Sweep Generator	MSG-2106	Integra
3.	Directional Coupler	1818	Krytar
4.	Attenuator	8493B-6	Hewlett-Packard
5.	Detector	33330B	Hewlett-Packard
6.	Oscilloscope	180A + 1801A	Hewlett-Packard
7.	Digital Voltage Calibrator	DVC-8500	Datel-Intersil
8.	Digital Voltmeter	3465B	Hewlett-Packard

FIGURE 9 CALIBRATION TEST SET-UP



*NOTE: DO NOT ADJUST

Fig. 10
Parts Locations

5.3 Circuit Description, IEEE-488 Interface Board

The 488 Board is controlled by way of the 488 Interface Buss. The data is received and transmitted by IC19 and IC20. LED (CR7) indicates the power-up procedure is complete. IC8 is the central processor which sends instructions to IC9 and IC10. IC9 controls IC1, which is a 16 bit digital to analog converter. IC1 provides the 0 to +10.000 V analog signal. IC21 inverts the analog signal to supply 0 to -10.000 V. IC10 provides the control signal for K1, 2, and 3 on the Mother Board.

6.0 Schematics and Assembly Drawings

4.1.4 External Drive Level Adjustments

Test No	Test Title	Inputs/Set-Up	Measure With DVM On	OSC On	Adj	Measure/Observe
1	zero input offset	open S1,S2,S3,S4,S5	CH3-12		R55	0.000 V
2		select .5 V/GHZ input apply +10.000 VDC on EXT DRIVE INPUT.	CH3-12		R4	+9.840 V
3		select 1 V/GHZ input apply +19.999 VDC on EXT DRIVE INPUT.	CH3-12		R3	+9.840 V
4	offset test	turn F1-ccw, close S1 input 0.000 V.	CH3-12			$\geq \pm 50$ mV
5	offset test	open S1, close S2.	CH3-12			$\geq \pm 100$ mV
6	offset test	open S2, close S3.	CH3-12			$\geq \pm 2.000$ V
7	offset test	turn F1-cw.	CH3-12			$\geq$ 2.000 V
8	offset test	open S3, close S2.	CH3-12			$\geq$ 0.100 V
9	offset test	open S2, close S1.	CH3-12			$\geq$ 0.050 V
10	offset test	open S1, close S4. select .5 V/GHz,F2-ccw input +10.000 V	CH3-12			< 9.865 V
11	offset test	open S4, close S5.	CH3-12			< 9.865 V
12	offset test	open S4, close S5.	CH3-12			< 9.865 V
13	offset test	F2 - cw.	CH3-12			> 10.135 V
14	offset test	open S5, close S4.	CH3-12			> 10.090 V
15		zero set of linearizer.	CH3-15		R46	0.00 V
16			CH3-2		R47	max neg voltage

4.2 Frequency Calibration

4.2.1 Connect instrument as shown in Fig. 9.

4.2.2 Select .5 V/GHZ and set S1 and S4 to ON and S2, S3, and S5 to OFF.

4.2.3 Set VOLTAGE CALIBRATOR to 1.000 V.

4.2.4 Measure @ CH3-12 adj. F1 for +1.000 V.

4.2.5 Set sweeper freq to 2.000 GHz.

4.2.6 Adj. R48 for max signal on scope.

4.2.7 Set VOLTAGE CALIBRATOR to 9.000 V

4.2.8 Measure @ CH3-12 adj. F2 for +9.000 V.

4.2.9 Set sweeper freq. to 18.000 GHz.

4.2.10 Adj. R49 for max signal on scope.

4.2.11 Repeat steps 4.2.3 thru 4.2.11 until both points calibrated.

4.3 IEEE-488 Calibration for Option-02

PROCEDURE: To be performed after all other voltage calibration. (Section 4.1) See Fig. 11 for Calibration Set Up.

NOTE: All Adj. are on IEEE-488 Interface Board and measurement points are on main board.

4.3.1 Open all switches S1 - S5 and set-up per Fig. 11.

4.3.2 Command with controller "0000011" and adj: R4 for 0.000 V on CH3-12.

4.3.3 Command "????011" and adj: R2 for - 10.000 V.

4.3.4 Repeat 2 and 3 until both correct.

4.3.5 Command "0000101" and adj: R 16 for 0.000 V.

4.3.6 Command "????101" and adj: R23 for +10.000 V.

4.3.7 Repeat 4.3.5 and 4.3.6 until both correct.

4.3.8 End of calibration.

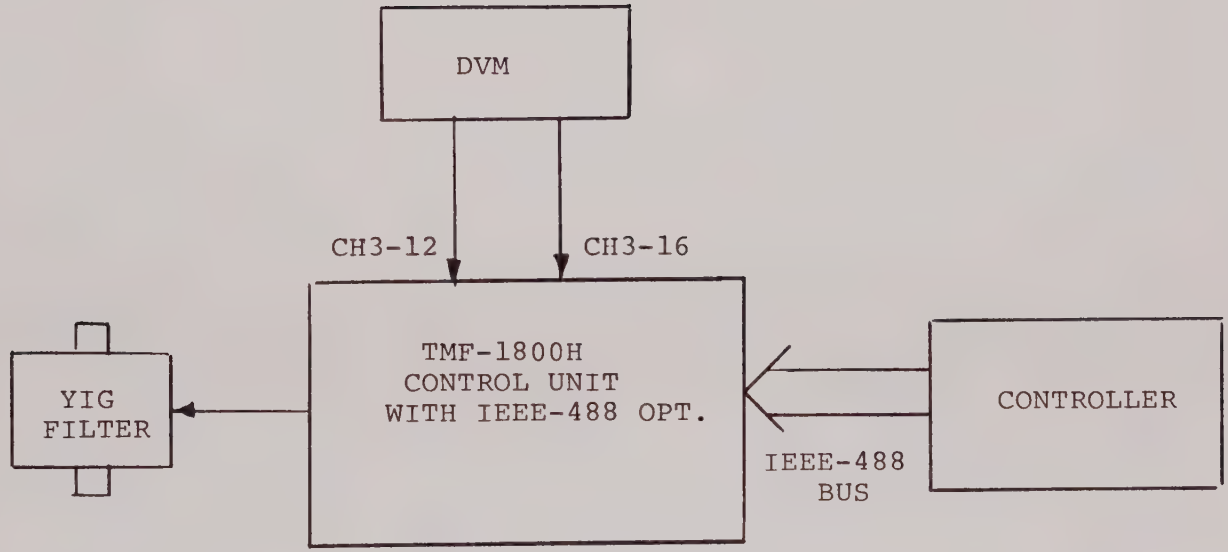


Fig. 11 IEEE-488 CALIBRATION SET UP

5.0 CIRCUIT DESCRIPTION

5.1 GENERAL

Figure 12 is a block diagram of the TMF-1800H. The drive input selector switch selects the 1 V/GHz or 0.5 V/GHz sensitivity for the EXT. drive input. The buffered analog output makes the input drive signal available for other instruments. The F1 control provides an offset adjustment compensating for the input drive signal (See table 1 for range). This offset is constant accross the entire tuning range. The F2 control provides a ± slope adjustment (See table 2 for range). This adjustment is proportional to frequency and is only effective on the external drive input (No effect on IEEE-488 Control). The drive section also incorporates a linearizer circuit and temperature compensation circuitry. The RF filter is connected to the Driver Unit through a 5 foot cable (10 ft, optional).

The IEEE-488 OPTION can control the Filter when positive Frequency Drive (Relay A) is selected. Relay B can enable a negative Frequency Drive. (Used together with the EXT. Drive Input to provide a negative frequency offset). Relay C is also controlled by the IEEE-488 Bus Interface and allows to disconnect the External Drive Input.

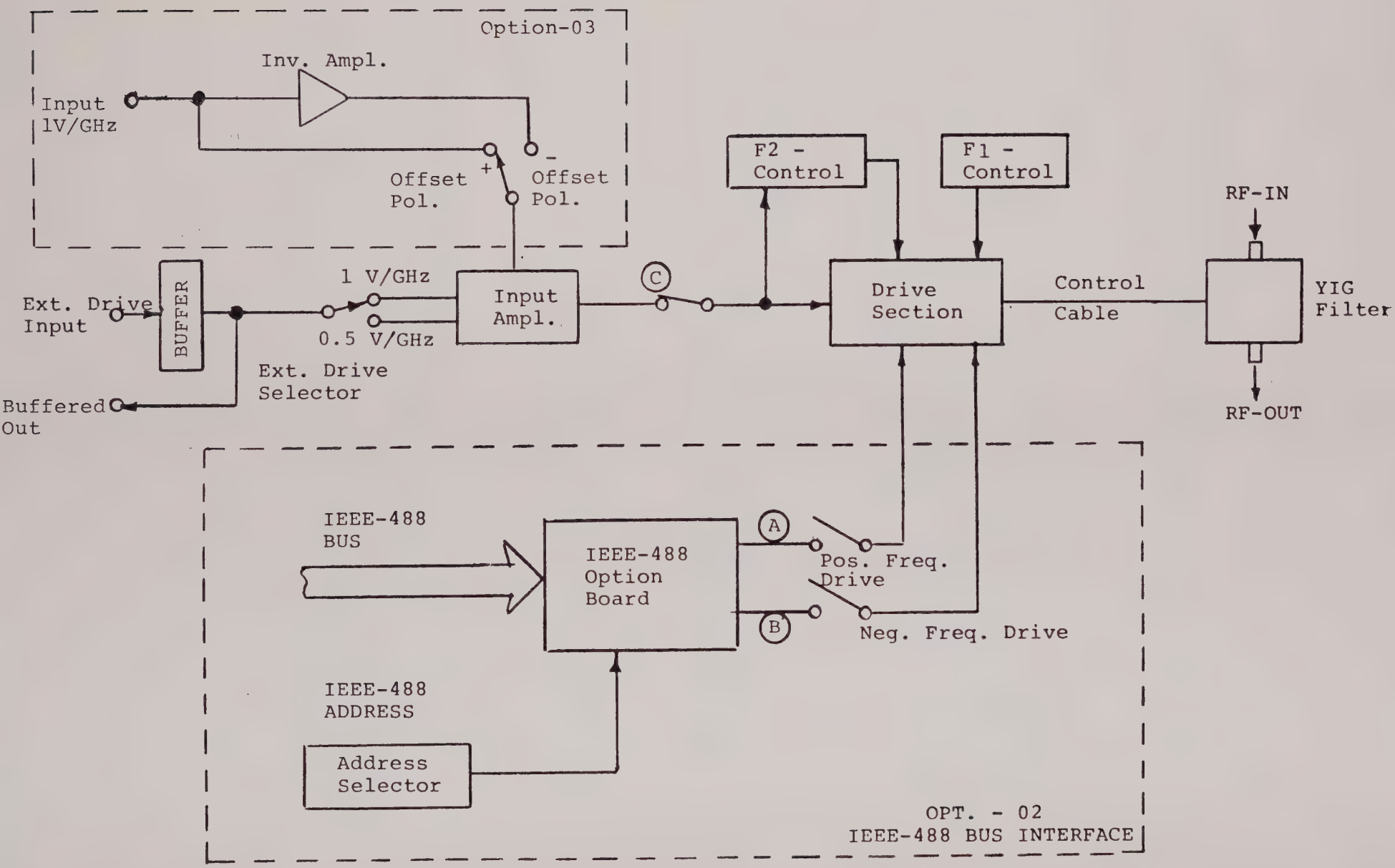


Fig. 12 TMF-Block Diagram

5.2 Circuit Description, Control Unit

(See TMF-1800H Interconnect and Schematic Mother Board TMF-1800H)

Power Supply

Transformer T1 has 3 secondary windings to feed 3 independent integrated regulators (VR1-3). Diodes CR5-CR12 and CR25-CR28 form three bridge rectifiers. Diodes CR13-16 and CR23-24 are reverse polarity protections for the integrated regulators. CR18 is a LED-power indicator for the front panel.

Ref. Voltage Supply

IC5 is a +10.000 V-Positive Ref. Supply (adjustable by R44). IC6 generates a -10.000 V reference voltage (adjustable by R45).

Buffer Amplifier

IC7 is a high voltage buffer amplifier for the EXT. Drive signal. The gain is +1.

EXT. Drive Input Amplifier

IC1 is an inverting amplifier and accepts either 0 to 20 V (on CH1-10) or 0 to 10 V (on CH1-9). R3 and R4 calibrate the input ranges. CR22 limits the output range and polarity of IC1.

INTERNAL SUMMING AMPLIFIER

IC2 is the internal summing amplifier. IC2, R13, and R16 form an inverting amplifier with a gain of -1. R55-R60 provide an offset voltage compensation for IC2.

R14, R80-82, R85, R86, S1-S3 in conjunction with the F1-Control potentiometer R15 give a positive or negative offset. The selector switches S1-S3 allows to select the desired range of F1-Control. (OFFSET CONTROL)

The output of IC1 (after passing through relay K1) is applied to the F2-Control (R11) and through S4, S5, R12, and R79 control the gain of IC2 in respect to the EXT. DRIVE INPUT. (SLOPE CONTROL)

Relay K1 controls the EXT. DRIVE INPUT to IC2. It is controlled by the IEEE-488 Interface Board. Its normal position (power up) is contacts closed.

Relay K2 applies a 0 to +10 V signal from the IEEE-488 Board to R76 for negative offset.

Relay K3 applies a 0 to -10 V signal from the IEEE-488 Board to R78 for positive offset (When used with EXT. INPUT DRIVE) or as the main drive signal when the EXT INPUT DRIVE is disconnected by Relay K1.

Remote Indicator Circuit

CR24-CR31, R73, 74, 83, 84, and R87 form a REMOTE-indicator. Whenever any of the 3 relays is activated, the REMOTE indicator CR31 lights up.

Yig Driver

IC3 is the YIG-Driver summing amplifier. R17, R18, and R48, allow YIG-LOW FREQUENCY CALIBRATION. R19, R20, and R49 are used for YIG HIGH FREQUENCY CALIBRATION. R21-23 and C8 is an optional YIG delay compensation circuit.

IC4 and Q1-Q4 form a current booster for the YIG driver. R31 is the current sense resistor and feeds back a voltage proportional to the YIG current.

Control Unit TC-Comp

CR35 is a temperature sensor and IC10 amplifies the voltage proportional to temperature. R105 and R106 are offset adjustment to set the output of IC10 to 0 V at room temperature. R99-R103 form a bridge circuit and allows setting of the desired amount of temperature compensation.

YIG-Offset TC-Comp

IC8 amplifies the output of a temperature sensor in the YIG unit. R64, R65 are offset adjustments to set the output of IC8 to 0 V at room temperature. R88, 89, and R114 control the amount of offset TC-COMP applied to IC3.

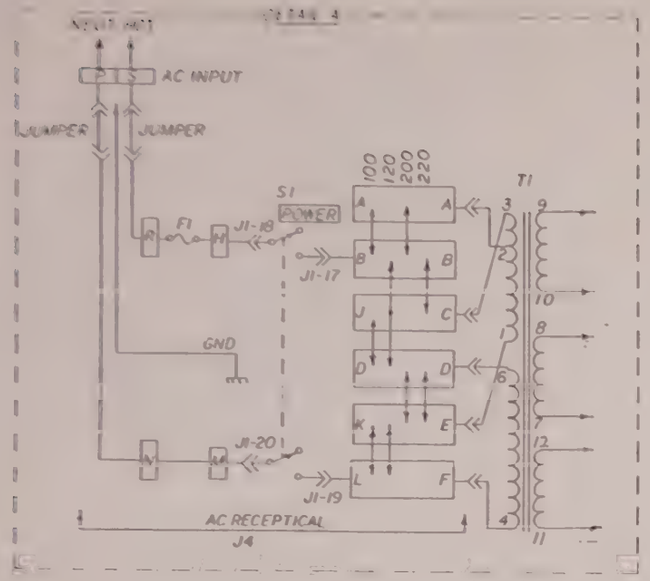
YIG-Scope TC-COMP

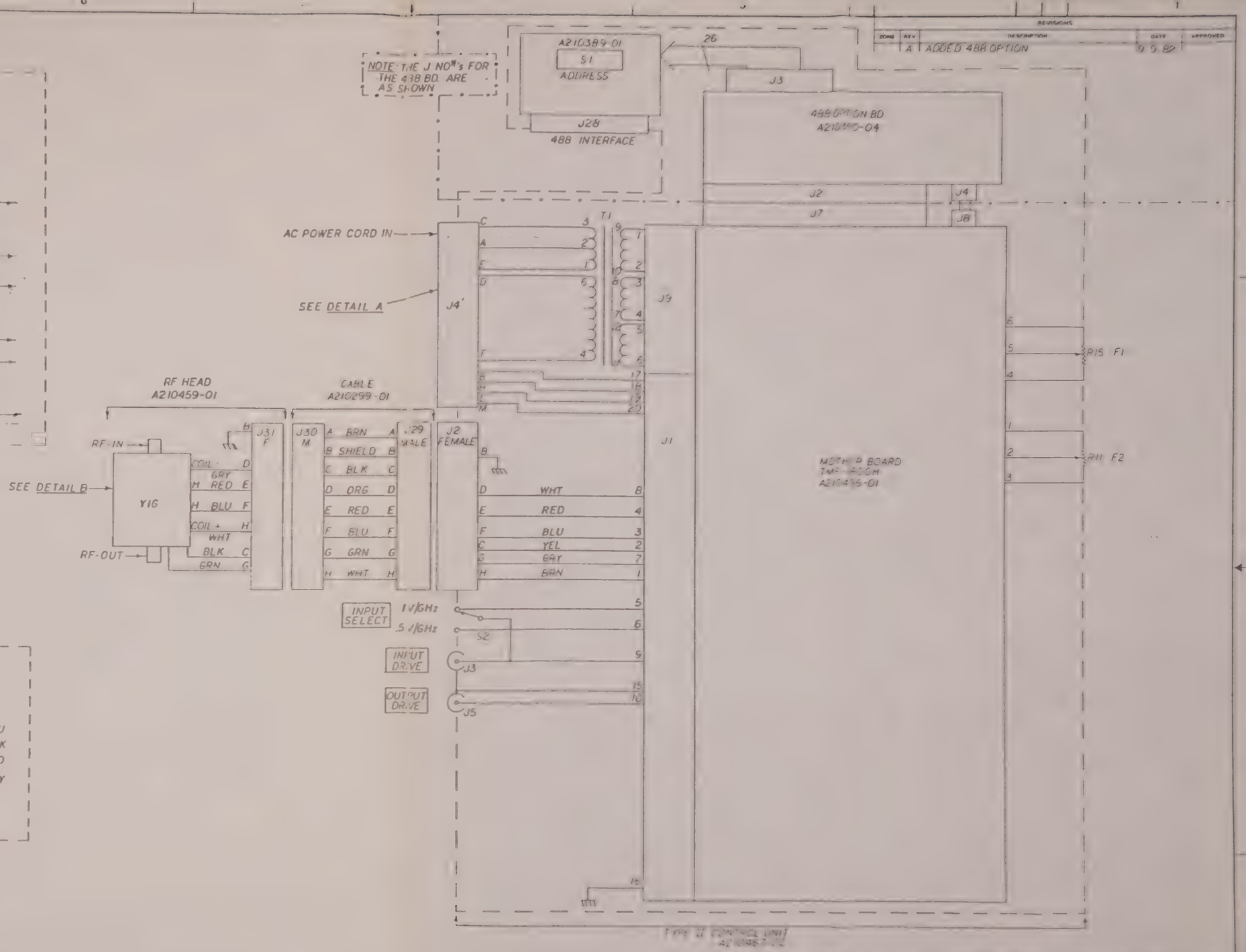
IC9 multiplies the drive signal (IC2-output) with the measured YIG temperature signal from output of IC8.

R67-71 form a bridge circuit and allows setting of the desired amount of temperature compensation.

YIG Linearizer

R38, 39, 46, 47, and CR3 form an adjustable linearizer circuit to compensate for YIG nonlinearity (Optional).





ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	ADDED 488 OPTION	9 9 82	

PARTS LIST

INTEGRA

TMF-1800H INTERCONNECT
WITH 488 OPTION

SIZE	FSCM NO	DWG NO	REV
D	51462	B110458-01	A

SCALE — SHEET

TMF-1800H			
TMF-1800J			
NEXT ASSY	USED ON		
APPLICATION	DO NOT SCALE DRAWING		

APPROVALS — DATE
DRAWN RLH 7-23-82
CHECKED
QA
COMP APPR
MFG APPR

8 7 6 5 4 3 2 1

ITEM	REV	DESCRIPTION	DATE	APPROVED
	A	ECO #156	7-27-82	

NOTE: JUMPER ON A OR B (NOT BOTH)

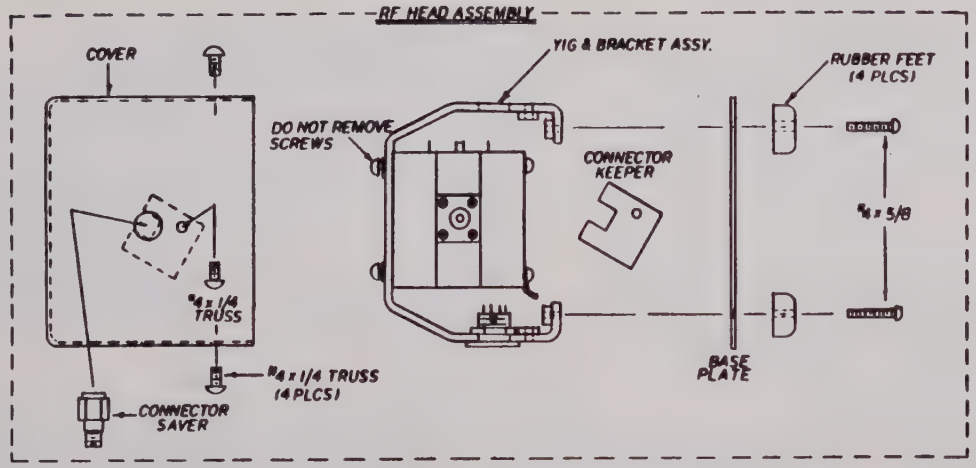
LAST USED: Q5, J9, S8, VR3, IC10, C37, CR35, R117

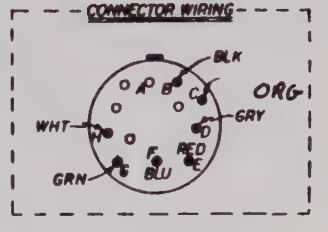
QTY REQD	FSCM NO	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

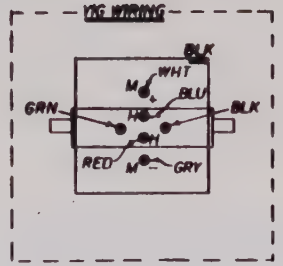
PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ±; DECIMALS ±; ANGLES ±°	CONTRACT NO	INTEGRA
MATERIAL	APPROVALS / DATE: DRAWN RLH 7-27-82; CHECKED 8-2-82	SCHEMATIC, TMF-1800 TYPE II CONTROL
DO NOT SCALE DRAWING		SIZE D; FSCM NO 51162; DWG NO B110456-01; REV B; SCALE —; SHEET

TMF-1800 CLH

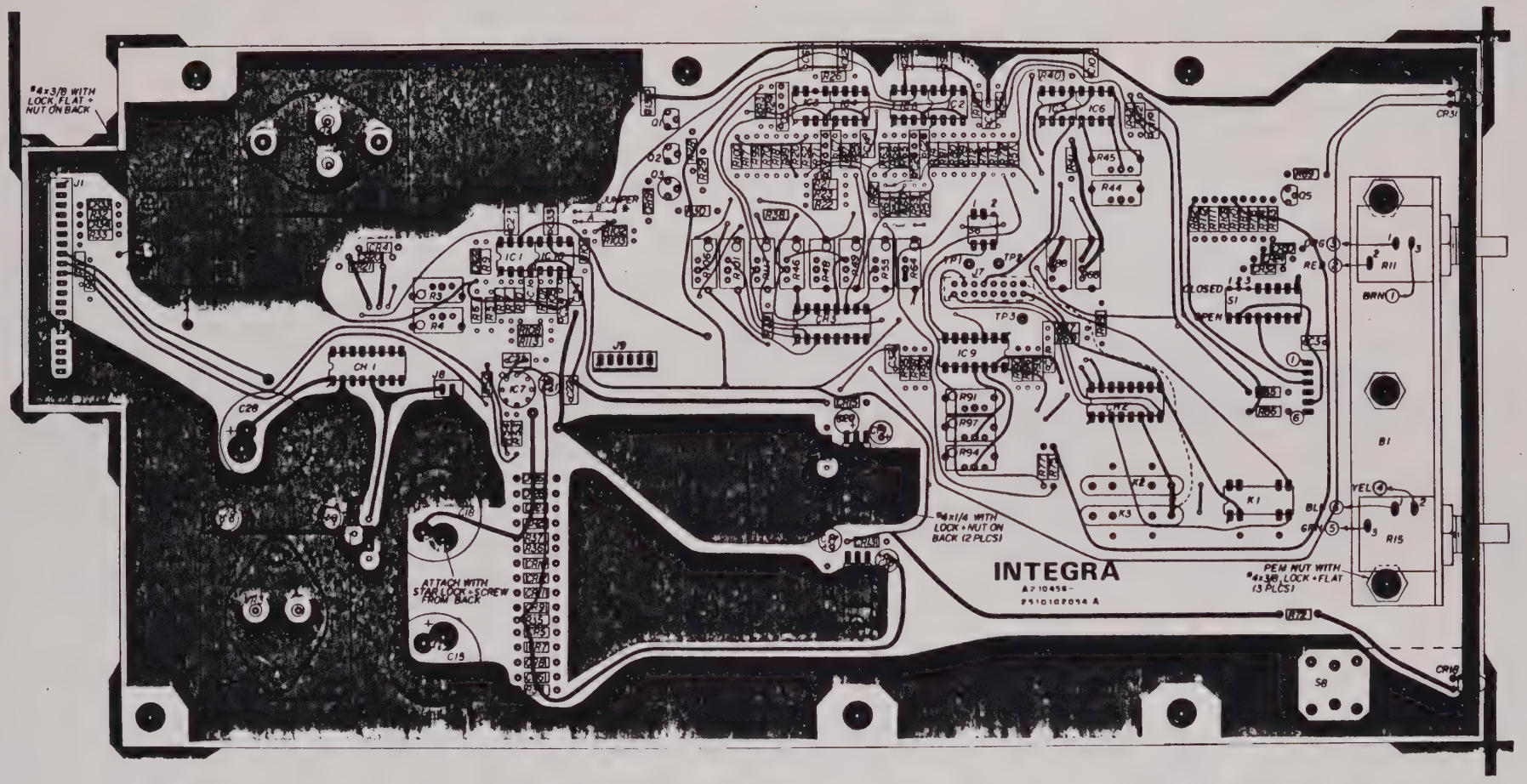




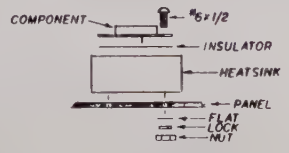


TMF-1800H		INTEGRA	
		RF HEAD ASSEMBLY	
RLH 7-25-02	C	51162	B210459-01
	SCALE		SHEET 1 OF 2

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
—	A	ECO 0167	10-7-82	[illegible]

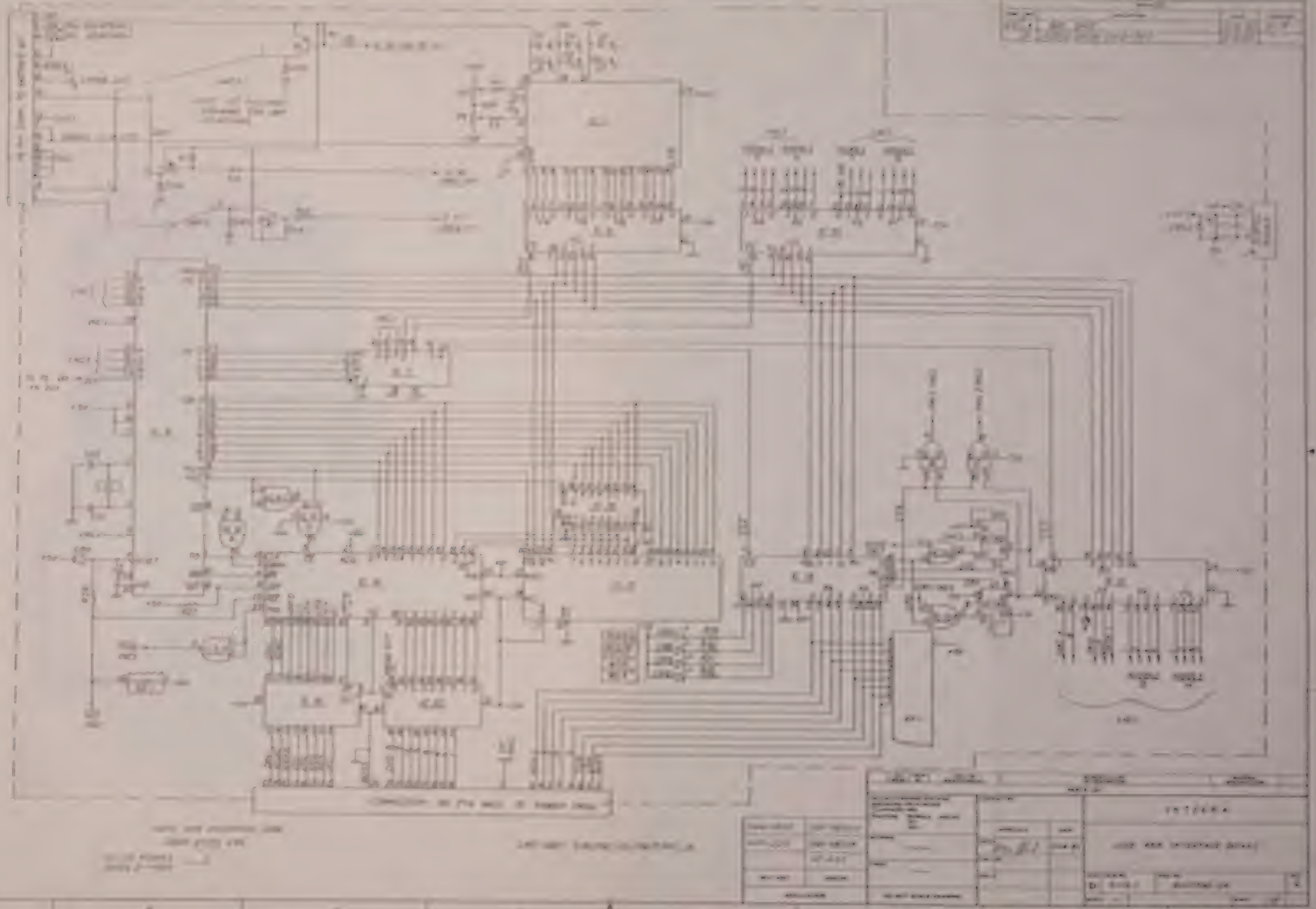


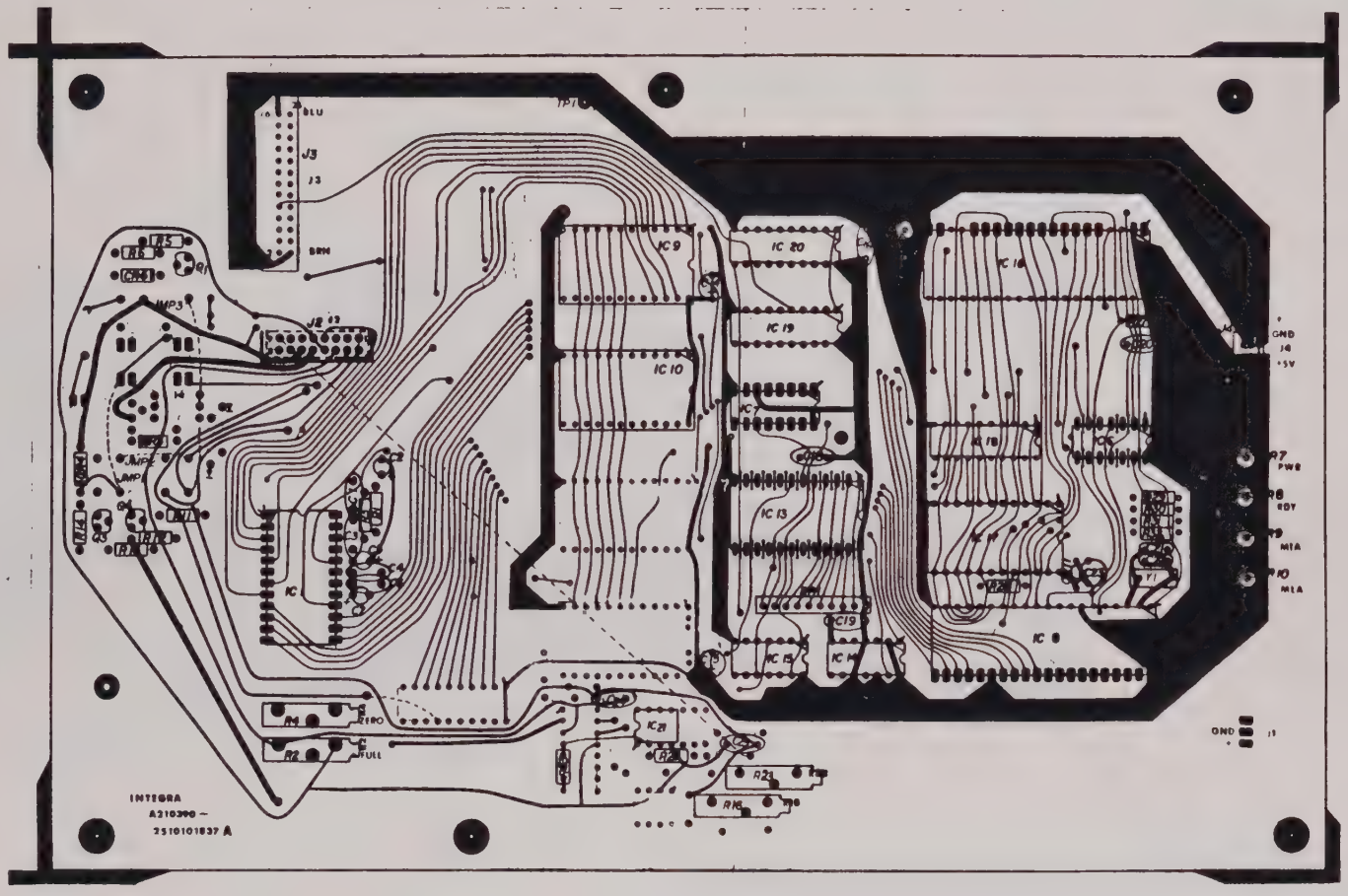
Q4 + VR3 ASSY.



#NOTE: JUMPER A OR B (NOT BOTH)

PARTS LIST		
		INTEGRA
		MOTHER BOARD ASSEMBLY
TMF-1600H		
MATERIAL	DRAWN RLH 8-30-82	
FINISH	CHECKED	
NEXT ASSY / USED ON	ISSUED	SIZE D — FSCM NO 51162 — DWG NO 8210456-01 — REV A
APPLICATION	DO NOT SCALE DRAWING	SCALE — SHEET





ZONE	REV	DESCRIPTION	DATE	APPROVED
4,5,8	A	ECO 0167	10-1-82	

PARTS LIST

	TMF-1800H
NEXT ASSY	USED ON
APPLICATION	

DO NOT SCALE DRAWING

CONTRACT NO	
APPROVALS	DATE
DRAWN	11-14-81
CHECKED	
ISSUED	

INTEGRA

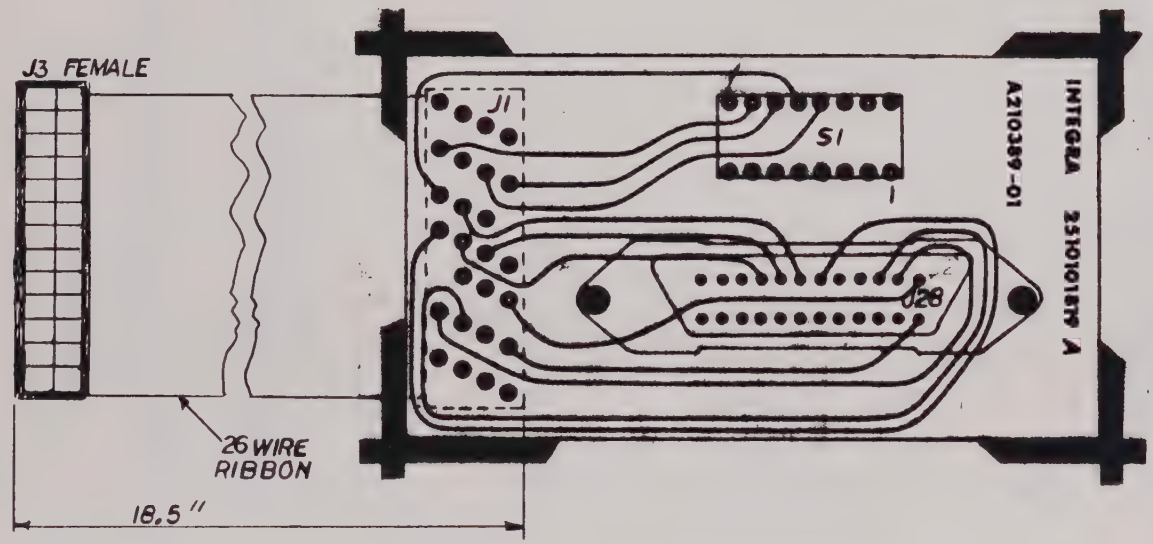
IEEE 488 INTERFACE BOARD

SIZE	FSCM NO.	DWG NO.	REV
D	51162	B210390-04	A

SCALE 2:1 SHEET 1 OF 1

DWG. NO	SH	REV

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED



QTY REQD	FSCM NO	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

	TMF 1800
	DWM 1800
	TMF 1800H
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN RH	7-9-81
CHECKED Wm M L	7-9-81
ISSUED	
Wm Schmid	7-9-81

INTEGRA

CONNECTOR/SWITCH BOARD

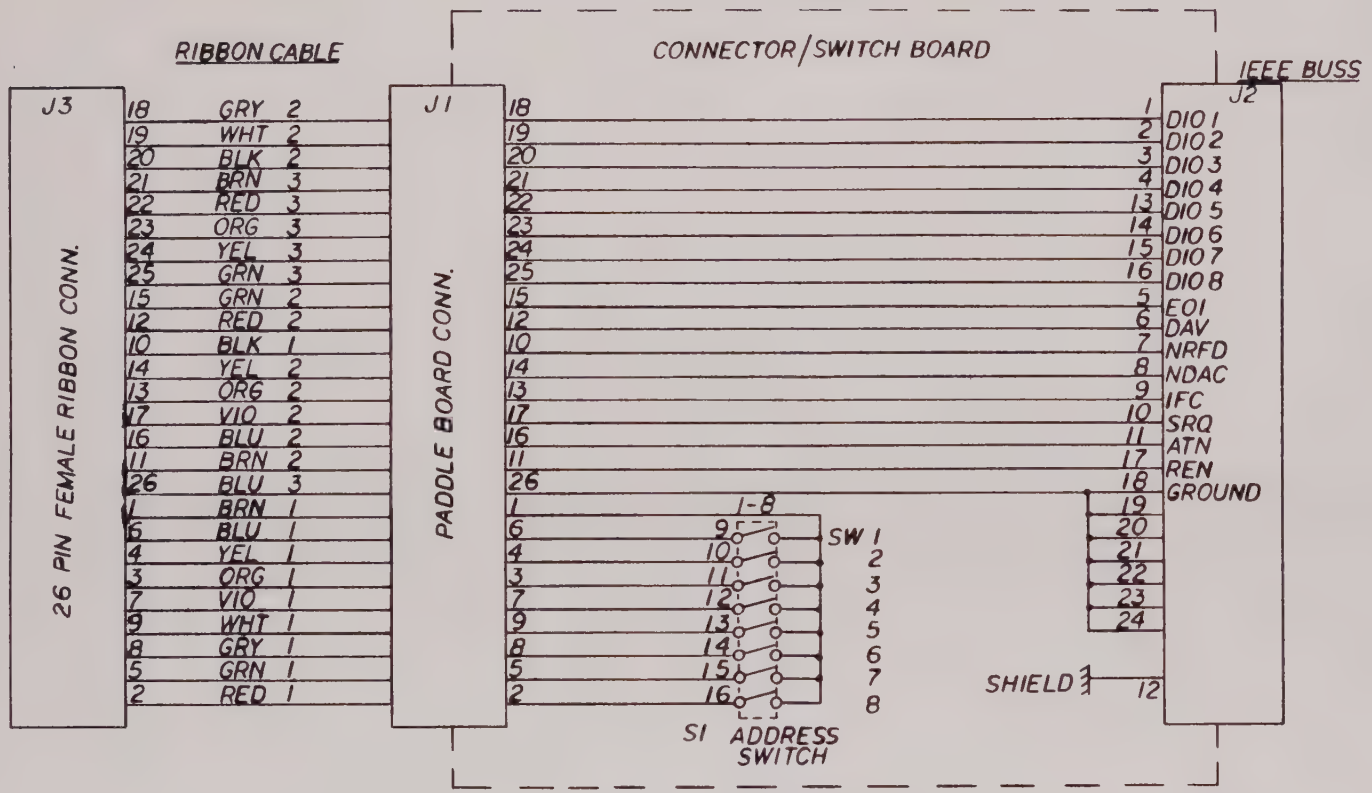
SIZE	FSCM NO.	DWG. NO.	REV.
B	51162	B210389-01	A

SCALE 2~1 SHEET

BISHOP GRAPHICS, INC.
REORDER NO. 20510

DWG. NO	SH	REV

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



QTY REQD	FSCM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

	ALL INST. WITH 488
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO

APPROVALS	DATE
DRAWN RLH	7-27-82
CHECKED	
ISSUED	

INTEGRA

488 PADDLE BOARD SCHEMATIC

SIZE	FSCM NO.	DWG. NO.	REV.
B	51162	B110389-01	

SCALE | SHEET

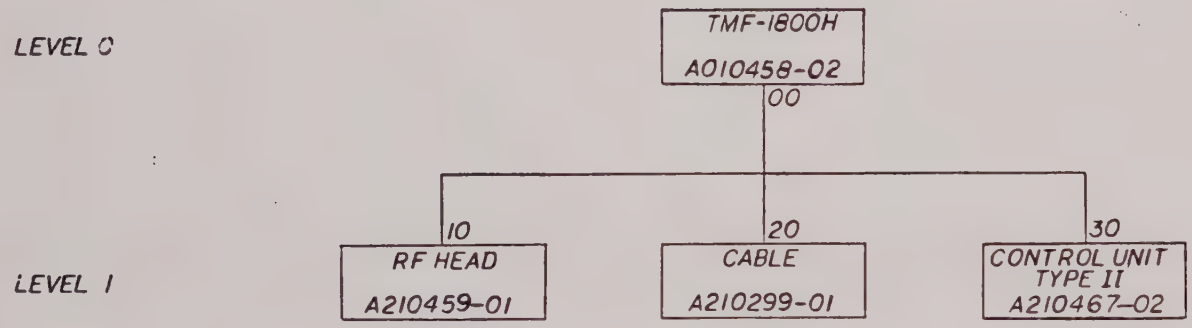
BISHOP GRAPHICS, INC
REORDER NO 20510

7.0 PARTS LIST

DWG. NO.	SH	REV.

REVISIONS

REV.	DESCRIPTION	DATE	APPROVED
A	ADDED 488 OPTION	8-30-82	



QTY REQD	FSCM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

	TMF-1800H
	TMF-1800J
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL —

FINISH —

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN RCB	4-20-83
CHECKED	
ISSUED	

INTEGRA

PRODUCT STRUCTURE
TMF TYPE II CONTROL

SIZE	FSCM NO.	DWG. NO.	REV.
B	51162	B710458-02	A

SCALE | SHEET

BISHOP GRAPHICS, INC
REORDER NO. 20510

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A010458-02
USED ON TMF-1800H
NEXT ASSEMBLY END ITEM
TITLE TMF-1800H

1 2 TC	DATE	7 9 CC	PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A0	10458-02			TMF-1800H	010	E	C	0026			00	0	END ITEM	5
		B6	10102140			MANUAL	010	E	7	0026			00	1	10458-02	5
		31	10100137			AC PWR CORD	010	E	7	0026			00	1	10458-02	5
		41	10101619			LABEL S/N	010	E	7	0026			00	1	10458-02	5
		54	10101711			SHIPPING CONTAINER	010	E	7	0026			00	1	10458-02	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210459-01
USED ON TMF-1800H
NEXT ASSEMBLY A010458-02
TITLE RF HEAD ASSEMBLY

1 2 TC	DATE	7 9 CC	PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A2	10459-01			RF HEAD ASSEMBLY	010	E	C	0026			10	1	10458-02	5
		A2	10329-02			YIG FILTER	010	E	S	0026			10	2	10459-01	5
		21	10100504			CONN SAVER	020	E	7	0026			10	2	10459-01	5
		31	10101673			WIRE, #24 ORG	050	I	7	0026			10	2	10459-01	5
		31	10101675			WIRE, #24 GRN	050	I	7	0026			10	2	10459-01	5
		31	10101676			WIRE, #24 BLU	050	I	7	0026			10	2	10459-01	5
		31	10101678			WIRE, #24 GRY	050	I	7	0026			10	2	10459-01	5
		31	10101679			WIRE, #24 WHT	050	I	7	0026			10	2	10459-01	5
		31	10101680			WIRE, #24 BLK	050	I	7	0026			10	2	10459-01	5
		31	10101681			WIRE, #24 RED	050	I	7	0026			10	2	10459-01	5
		41	10100236			WRAP, TIE	020	E	7	0026			10	2	10459-01	5
		41	10100520			CAN	010	E	7	0026			10	2	10102068	5
		41	10101381			CONN	010	E	7	0026			10	2	10459-01	5
		41	10101619			LABEL S/N	010	E	7	0026			10	2	10459-01	5
		41	10102094			RUBBER BUMPERS	040	E	7	0026			10	2	10459-01	5
		42	10004-03			SCREWS 4-40 X 3/8	040	E	7	0026			10	2	10459-01	5
		42	10102095			SCREWS 4-40 X 1/4	060	E	7	0026			10	2	10459-01	5
		52	10102069			LABEL PROD ID	010	E	7	0026			10	2	10459-01	5
		52	10102070			LABEL RF-INPUT	010	E	7	0026			10	2	10459-01	5
		52	10102112			LABEL RF-OUTPUT	010	E	7	0026			10	2	10459-01	5
		72	10102060			YIG HOLDER	010	E	7	0026			10	2	10459-01	5
		72	10102067			PLATE	010	E	7	0026			10	2	10459-01	5
		72	10102068			COVER, RF HEAD	010	E	2	0026			10	2	10459-01	5
		72	10100450			PLATE, LOCK	020	E	3	0026			10	2	10100450	5
		72	10100929			PLATE, ALUM	020	E	7	0026			10	2	10450-01	5

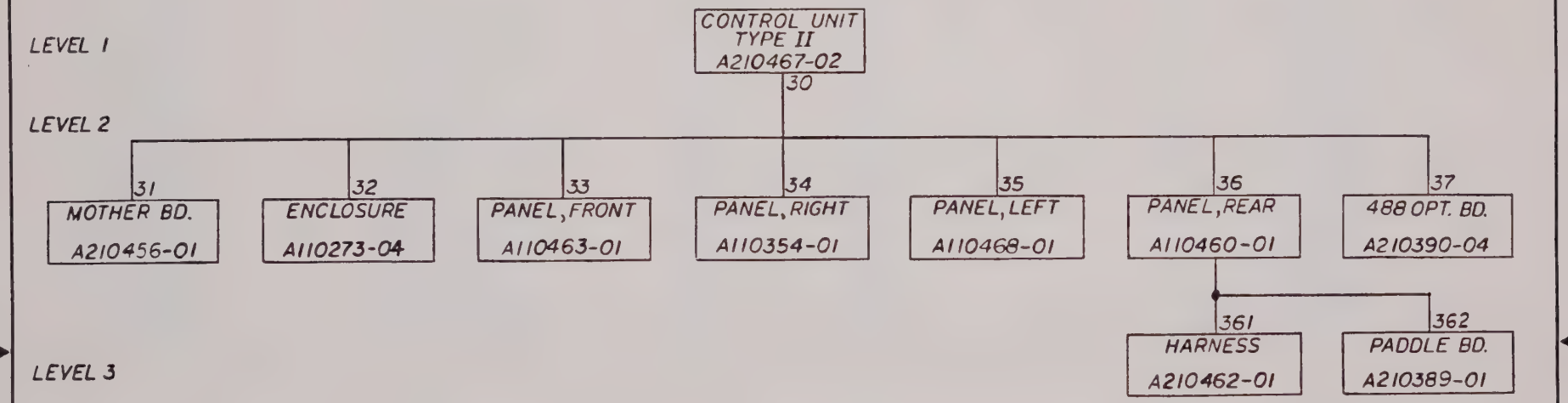
INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210299-01
USED ON TMF-1800H
NEXT ASSEMBLY A010458-02
TITLE CABLE, INTERCONNECT

1 2 TC	DATE	7 CC	9 PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A2	10299-01			CABLE, INTERCONNECT	010	E	C	0026			20	1	10458-02	5
		31	10101509			CABLE	050	F	7	0026			20	2	10299-01	5
		41	10101380			CONN	020	E	7	0026			20	2	10299-01	5

DWG NO.	SH	REV

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	ADDED 488 OPTION	8-30-82	



QTY REQD	FSCM NO	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS XX ± XXX ± ANGLES ±

MATERIAL —

FINISH —

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN RCB	4-20-83
CHECKED	
ISSUED	

INTEGRA

PRODUCT STRUCTURE
TYPE II CONTROL

SIZE	FSCM NO.	DWG. NO.	REV.
B	51162	B710467-02	A

SCALE | SHEET

TMF-1800H, J, K, L1, L2, M	
HPF-220	
NEXT ASSY	USED ON
APPLICATION	

BISHOP GRAPHICS, INC
REORDER NO 20510

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210467-02
USED ON TMF-1800H
NEXT ASSEMBLY A010458-02
TITLE TMF-TYPE II CONTROL UNIT

1 2 TC	DATE	7 CC	9 PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
A2			10467-02		A	CONTROL UNIT	010	E	C	0026			30	1	10458-02	5
16			10100502			FUSE 1 AMP	010	E	7	0026			30	2	10467-02	5
41			10100270			KNOB	020	E	7	0026			30	2	10467-02	5
41			10100272			CAP	020	E	7	0026			30	2	10467-02	5
41			10100281			RETAINER, STRAP	040	E	9	0026			30	2	10101776	5
41			10100283			FEET	040	E	9	0026			30	2	10467-02	5
41			10100470			EXTRU, FRONT	020	E	9	0026			30	2	10467-02	5
41			10101224			PANEL,DECORATIVE	020	E	9	0026			30	2	10467-02	5
41			10101225			STRAP	020	E	9	0026			30	2	10467-02	5
41			10101582			COVER, TOP	010	E	9	0026			30	2	10467-02	5
41			10101583			COVER, BOTTOM	010	E	9	0026			30	2	10467-02	5
42			10007-04			SCREW, #6-1/2	060	E	9	0034			30	2	10467-02	5
42			10303-16			SCREW, #6-3/4, BLK	040	E	7	0026			30	2	10467-02	5
42			10100277			SCREW, #6-3/4	080	E	9	0026			30	2	10467-02	5
42			10100284			SCREW, #6-ST	050	E	9	0026			30	2	10467-02	5
42			10100334			NUT, HEX #8	040	E	9	0026			30	2	10467-02	5
42			10100335			SCREW, SPOTWELD	040	E	9	0026			30	2	10467-02	5
42			10100337			SCREW, #8-1/2	040	E	9	0026			30	2	10467-02	5
43			10100074			WASH, #6 FL	100	E	7	0034			30	2	10467-02	5
43			10100075			WASH, #6 SPL	100	E	7	0034			30	2	10467-02	5
43			10100278			WASHER, NYLON	080	E	9	0026			30	2	10467-02	5
72			10101776			RETAINER, STRAP	040	E	3	0026			30	2	10467-02	5

ASSEMBLY # A210456-01
USED ON TMF-1800H & J
NEXT ASSEMBLY A010467-02
TITLE MOTHER BOARD

1 2 TC DATE	7 9 CC PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
	A2 10456-01		B	MOTHER BD.	010	E	7	0034			31	2	10467-01	5
	13 10100434			C MICA 91 PF	010	E	7	0034	C 23		31	3	10456-01	5
	13 10100543			C CER .01uF	220	E	7	0034	C 1-4,6,7,9-14,22, 24,26,27,31-37		31	3	10456-01	5
	13 10100899			C SAT	020	E	7	0034	C 5,8		31	3	10456-01	5
	13 10101900			C ELECT 10uF 25V	040	E	7	0034	C 17,20,21,30		31	3	10456-01	5
	13 10101901			C ELECT, 1uF 50V	030	E	7	0034	C 16,19,29		31	3	10456-01	5
	13 10102164			CAP ELEC 4700uF	030	E	7	0034	C 15,18,28		31	3	10456-01	5
	15 10100016			DIODE 5.1V	020	E	7	0034	CR 33,34		31	3	10456-01	5
	15 10100019			DIODE IN4148	040	E	7	0034	CR 3,29,30,32		31	3	10456-01	5
	15 10101137			DIODE IN6159	010	E	7	0034	CR 4		31	3	10456-01	5
	15 10101633			DIODE IN4004	190	E	7	0034	CR 5-16,19,23-28		31	3	10456-01	5
	17 10100383			LED, YEL	010	E	7	0034	CR 31		31	3	10456-01	5
	17 10100384			LED, GREEN	010	E	7	0034	CR 18		31	3	10456-01	5
	19 10100045			IC LIN	010	E	7	0034	VR 3		31	3	10456-01	5
	19 10100114			IC LIN LM741	020	E	7	0034	IC 6,11		31	3	10456-01	5
	19 10100116			IC LIN LM307	060	E	7	0034	IC 1-4,8,10		31	3	10456-01	5
	19 10100741			IC LIN REF-01	010	E	7	0034	IC 5		31	3	10456-01	5
	19 10101637			IC LIN +15V	010	E	7	0034	VR 1		31	3	10456-01	5
	19 10101638			IC LIN -15V	010	E	7	0034	VR 2		31	3	10456-01	5
	19 10101888			IC AD 533	010	E	7	0034	IC 9		31	3	10456-01	5
	19 10102052			DIODE TEMP	010	E	7	0034	CR 35		31	3	10456-01	5
	19 10102059			IC LM 344	010	E	7	0034	IC 7		31	3	10456-01	5
	25 10102054		B	PCB	010	E	7	0034			31	3	10456-01	5
	26 10100785			RELAY	020	E	7	0034	K 2,3		31	3	10456-01	5
	26 10101629			RELAY	010	E	7	0034	K 1		31	3	10456-01	5
	27 10100110			R CARB 10K	040	E	7	0034	R 73,74,83,87		31	3	10456-01	5
	27 10100190			R MF 100	020	E	7	0034	R 32,33		31	3	10456-01	5
	27 10100286			R MF 20.0K	070	E	7	0034	R 9,34-37,57,58		31	3	10456-01	5
	27 10100289			R MF 10.0K	120	E	7	0034	R 29,51,67,69,90,92, 93,95,96,98,102,103		31	3	10456-01	5
	27 10100410			R CARB 10 MEG	010	E	7	0034	R 89		31	3	10456-01	5
	27 10100436			R MF 49.9K	050	E	7	0034	R 1,2,14,53,54		31	3	10456-01	5
	27 10100465			R CARB 1 OHM	010	E	7	0034	R 50		31	3	10456-01	5
	27 10100466			R WW 3 OHM 1% 25W	010	E	7	0034	R 31		31	3	10456-01	5
	27 10100585			R MF 39.2K	010	E	7	0034	R 40		31	3	10456-01	5
	27 10100599			R MF 100K	100	E	7	0034	R 28,65,75,77,82, 105,109-112		31	3	10456-01	5
	27 10100601			R MF 7.50K	030	E	7	0034	R 10,61,113		31	3	10456-01	5
	27 10100602			R MF 3.01K	020	E	7	0034	R 24,52		31	3	10456-01	5

1 2 TC	DATE	7 CC	9 PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		27	10100609			R MF 1.00 M	040	E	7	0034	R 56,70,71,81		31	3	10456-01	5
		27	10100610			R MF 1.00 K	080	E	7	0034	R 25-27,30,41,59,60,72		31	3	10456-01	5
		27	10100743			R CARB 510	010	E	7	0034	R 84		31	3	10456-01	5
		27	10100777			SAT	030	E	7	0034	R 21-23		31	3	10456-01	5
		27	10101018			R MF 499K	020	E	7	0034	R 66,104		31	3	10456-01	5
		27	10101033			R MF 13.7K	020	E	7	0034	R 63,107		31	3	10456-01	5
		27	10101088			R MF 19.1K	010	E	7	0034	R 116		31	3	10456-01	5
		27	10101132			R MF 3.92K	010	E	7	0034	R 85,86		31	3	10456-01	5
		27	10101385			R MF 20.0K .1%	070	E	7	0034	R 13,16,42,43,76, 78,114		31	3	10456-01	5
		27	10101528			R MF 18.2K	020	E	7	0034	R 62,108		31	3	10456-01	5
		27	10101877			R CARB 2.4M	020	E	7	0034	R 99,100		31	3	10456-01	5
		27	10102173			R CARB 2M	010	E	7	0034	R 80		31	3	10456-01	5
		27	10102214			R MF 1.2M	010	E	7	0034	R 38		31	3	10456-01	5
		28	10100010			R VAR 10K, 10T	020	E	7	0034	R 11,15		31	3	10456-01	5
		28	10101960			R VAR 1K	010	E	7	0034	R 4		31	3	10456-01	5
		28	10101961			R VAR 2K	020	E	7	0034	R 3,117		31	3	10456-01	5
		28	10101962			R VAR 10K	070	E	7	0034	R 44,45,55,64,88, 106,115		31	3	10456-01	5
		28	10101963			R VAR 20K	050	E	7	0034	R 68,91,94,97,101		31	3	10456-01	5
		28	10101964			R VAR 100K	040	E	7	0034	R 46-49		31	3	10456-01	5
		30	10100092			TRANSISTOR NPN	010	E	7	0034	Q 5		31	3	10456-01	5
		30	10100196			TRANS, 2N5401	020	E	7	0034	Q 1,2		31	3	10456-01	5
		30	10100233			TRANS, MM4001	010	E	7	0034	Q 3		31	3	10456-01	5
		30	10100237			TRANS, 2N6228	010	E	7	0034	Q 4		31	3	10456-01	5
		41	10100084			SOCKET 14 PIN	010	E	7	0034			31	3	10456-01	5
		41	10100124			SOCKET 8 PIN	010	E	7	0034			31	3	10456-01	5
		41	10100128			SOCKET 16 PIN	070	E	7	0034			31	3	10456-01	5
		41	10100239			HEATSINK	010	E	7	0034	H 1		31	3	10456-01	5
		41	10100665			COVER, IC	010	E	7	0034			31	3	10456-01	5
		41	10101093			SWITCH POWER	010	E	7	0034	S 1		31	3	10456-01	5
		41	10101552			S DIP	010	E	7	0034	S 6		31	3	10456-01	5
		41	10101622			POST HEADER FRICTION LK	010	E	7	0034	J 1		31	3	10456-01	5
		41	10101624			POST HEADER FRICTION LK	010	E	7	0034	J 8		31	3	10456-01	* 5
		41	10101626			CONNECTOR	010	E	7	0034	J 7		31	3	10456-01	5
		41	10101631			DIP PLUG, 16 PIN	010	E	7	0034			31	3	10456-01	5
*		41	10101852			S DIP	010	E	7	0034	S 1		31	3	10456-01	5
		41	10102074			POST HEADER FRICTION LK	010	E	7	0034	J 9		31	3	10456-01	5

1 2 TC	DATE	7 9 CC	PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		42	10004-02			SCREW 4-40 1/4	020	E	7	0034			31	3	10456-01	5
		42	10004-03			SCREW 4-40 3/8	050	E	7	0034			31	3	10456-01	5
		42	10007-03			SCREW 6-32 3/8	020	E	7	0034			31	3	10456-01	5
		42	10218-04			SCREW 6-32 1/2	040	E	7	0034			31	3	10456-01	5
		42	10100070			NUT #6	040	E	7	0034			31	3	10456-01	5
		42	10100175			NUT #4	040	E	7	0034			31	3	10456-01	5
		42	10101657			SPACER	060	E	7	0034			31	3	10456-01	5
		43	10100074			WASHER FLAT #6	040	E	7	0034			31	3	10456-01	5
		43	10100075			WASHER SPLIT #6	060	E	7	0034			31	3	10456-01	5
		43	10100179			WASHER FLAT #4	050	E	7	0034			31	3	10456-01	5
		43	10100180			WASHER SPLIT #4	040	E	7	0034			31	3	10456-01	5
		43	10100188			INSULATOR	010	E	7	0034			31	3	10456-01	5
		50	10102143			FISH PAPER	230	I	7	0034			31	3	10102085	5
		52	10101974			MYLAR TAPE	030	I	7	0034	TP 1		31	3	10456-01	5
		72	10101579			BRACKET PC MOUNT	060	E	7	0034	B 3-8		31	3	10456-01	5
		72	10102055			PANEL SUB	010	E	7	0034	B 1		31	3	10456-01	5
		72	10102166			BRACKET, HEATSINK	010	E	7	0034	B 2		31	3	10456-01	5
		72	10102170			BRACKET HEATSINK	010	E	7	0034			31	3	10102166	5
		73	10102085			PROT COVER, AC POWER	010	E	3	0034			31	3	10456-01	5
		27	10100289			R MF 10.0K	020	E	7	0026	R 7,8		31	3	10456-01	5
		27	10100442			R MF 9.76K	010	E	7	0026	R 6		31	3	10456-01	5
		27	10100607			R MF 150K	010	E	7	0026	R 19		31	3	10456-01	5
		27	10100609			R MF 1.00M	010	E	7	0026	R 17		31	3	10456-01	5
		27	10101018			R MF 499K	010	E	7	0026	R 18		31	3	10456-01	5
		27	10101281			R MF 21.5K	010	E	7	0026	R 20		31	3	10456-01	5
		27	10101636			R MF 732K	010	E	7	0026	R 79		31	3	10456-01	5
		27	10101877			R CARB 2.4M	010	E	7	0026	R 39		31	3	10456-01	5
		27	10102078			R MF 29.4K	010	E	7	0026	R 5		31	3	10456-01	5
		27	10102081			R MF 604K	010	E	7	0026	R 12		31	3	10456-01	5
		27	10102141			R MF 866K	010	E	7	0026	R 38		31	3	10456-01	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A110273-04
USED ON TMF-1800H
NEXT ASSEMBLY A210467-02
TITLE ENCLOSURE

1 2 TC	DATE	7 CC	9 PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A1	10273-04			ENCLOSURE	010	E	7	0026			32	2	10467-02	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A110463-01
USED ON TMF-1800H
NEXT ASSEMBLY A110467-02
TITLE PANEL FRONT

1 2 TC	DATE	7 CC	9 PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A1	10463-01		A	PANEL, FRONT	010	E	C	0026			32	2	10467-02	5
		41	10100901			ALUM, BLK	500	C	7	0026			32	2	10102062	5
		72	10102057			PANEL, FRONT	010	E	7	0026			32	3	10463-01	5
		72	10102062			LABEL, FRONT PANEL	010	E	3	0026			32	3	10463-01	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A110354-01
USED ON TMF-1800H
NEXT ASSEMBLY A210467-02
TITLE PANEL, SIDE RIGHT

1 2 TC	DATE	7 CC	9 PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A1	10354-01			PANEL, SIDE RT	010	E	C	0026			34	2	10467-02	5
		41	10100326			CAST, CNR FR	010	E	9	0026			34	3	10354-01	5
		41	10100327			CAST, CNR RE	010	E	9	0026			34	3	10354-01	5
		41	10101062			EXTRU, SIDE	020	E	9	0026			34	3	10354-01	5
		41	10101226			PLATE, STRU SID	010	E	9	0026			34	3	10101591	5
		41	10101591		A	PANEL, SIDE RIGHT	010	E	3	0026			34	3	10354-01	5
		42	10007-04			SCREW, #6-1/2	030	E	7	0026			34	3	10354-01	5
		42	10100332			NUT, CLIP	040	E	9	0026			34	3	10354-01	5
		42	10100333			NUT, CLIP	040	E	9	0026			34	3	10354-01	5
		42	10100334			NUT, HEX #8	040	E	9	0026			34	3	10354-01	5
		42	10100335			SCREW, SPOTWELD	040	E	9	0026			34	3	10354-01	5
		43	10100074			WASH, #6 FL	030	E	7	0026			34	3	10354-01	5
		43	10100075			WASH, #6 SPL	030	E	7	0026			34	3	10354-01	5
		72	10101579			BRKT, PCB MT	030	E	7	0026			34	3	10354-01	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A110468-01
USED ON TMF-1800H
NEXT ASSEMBLY A210467-02
TITLE PANEL, SIDE LEFT

1 2 TC	DATE	7 CC	9 PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A1	10468-01			PANEL, SIDE LF	010	E	C	0026			35	2	10467-02	5
		29	10101617			TRANSFORMER	010	E	7	0026			35	2	10468-01	5
		41	10100326			CAST,CNR FR	010	E	9	0026			35	3	10468-01	5
		41	10100327			CAST,CNR RE	010	E	9	0026			35	3	10468-01	5
		41	10101062			EXTRU,SIDE	020	E	9	0026			35	3	10468-01	5
		41	10101226			PLATE,STRU SID	010	E	9	0026			35	3	10101592	5
		41	10101592		C	PANEL, SID LF	010	E	3	0026			35	3	10468-01	5
		42	10007-04			SCREW, #6-1/2	070	E	7	0026			35	3	10468-01	5
		42	10100332			NUT, CLIP	040	E	9	0026			35	3	10468-01	5
		42	10100333			NUT, CLIP	040	E	9	0026			35	3	10468-01	5
		42	10100334			NUT, HEX #8	040	E	9	0026			35	3	10468-01	5
		42	10100335			SCREW, SPOTWELD	040	E	9	0026			35	3	10468-01	5
		43	10100074			WASH, #6 FL	070	E	7	0026			35	3	10468-01	5
		43	10100075			WASH, #6 SPL	070	E	7	0026			35	3	10468-01	5
		72	10101579			BRKT,PCB MT	030	E	7	0026			35	3	10468-01	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A110460-01
USED ON TMF-1800H
NEXT ASSEMBLY A110467-02
TITLE PANEL REAR

1 2 TC	DATE	7 9 CC	PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A1	10460-01		A	PANEL, REAR	010	E	C	0026		36	2		10467-02	5
		16	10100502			FUSE, 1 AMP SB	010	E	7	0026		36	3		10460-01	5
		41	10100125			BNC	020	E	7	0026		36	3		10460-01	5
		41	10100901			ALUM, BLK	500	C	7	0026		36	3		10460-01	5
		41	10101087			RECEPT, A/C	010	E	7	0026		36	3		10460-01	5
		41	10101118			SWITCH, TOGGLE	010	E	7	0026		36	3		10460-01	5
		41	10101381			CONN	010	E	7	0026		36	3		10460-01	5
		72	10102056			PANEL, REAR	010	E	7	0026		36	3		10460-01	5
		72	10102061			LABEL, REAR PANEL	010	E	3	0026		36	3		10460-01	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210462-01
USED ON TMF-1800H
NEXT ASSEMBLY A110460-01 REV A
TITLE HARNESS

1 2 TC	DATE	7 CC	9 PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A2	10462-01		A	HARNESS	010	E	6	0026			361	3	10460-01	5
		31	10100262			WIRE, #20 RED	030	F	7	0026			361	4	10462-01	5
		31	10100263			WIRE, #20 BLU	030	F	7	0026			361	4	10462-01	5
		31	10101672			WIRE, #24 BRN	020	F	7	0026			361	4	10462-01	5
		31	10101674			WIRE, #24 YEL	020	F	7	0026			361	4	10462-01	5
		31	10101675			WIRE, #24 ORG	020	F	7	0026			361	4	10462-01	5
		31	10101676			WIRE, #24 BLU	020	F	7	0026			361	4	10462-01	5
		31	10101677			WIRE, #24 VIO	010	F	7	0026			361	4	10462-01	5
		31	10101678			WIRE, #24 GRY	010	F	7	0026			361	4	10462-01	5
		31	10101679			WIRE, #24 WHT	010	F	7	0026			361	4	10462-01	5
		31	10101680			WIRE, #24 BLK	020	F	7	0026			361	4	10462-01	5
		31	10101681			WIRE, #24 RED	020	F	7	0026			361	4	10462-01	5
		41	10100236			WRAP, TIE	500	E	7	0026			361	4	10462-01	5
		41	10101621			CONN	010	E	7	0026			361	4	10462-01	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210389-01
USED ON TMF-1800H
NEXT ASSEMBLY A110460-01
TITLE 488 PADDLE BOARD

1 2 TC DATE	7 9 CC PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
	A2 10389-01			CONN SWITCH BD	010	E	C	0001			362	3	10460-01	5
	25 10101819			PCB	010	E	7	0001			362	4	10389-01	5
	31 10101813			RIBBON CABLE	190	I	7	0001			362	4	10389-01	5
	41 10101149			STANDOFF KIT	010	E	7	0001			362	4	10389-01	5
	41 10101816			CONN, 26 PIN FEMALE	010	E	7	0001			362	4	10389-01	5
	41 10101817			488 CONNECTOR	010	E	7	0001			362	4	10389-01	5
	41 10101814			PADDLE BD CONN	010	E	7	0001			362	4	10389-01	5
	41 10101852			SWITCH	010	E	7	0001			362	4	10389-01	5

INTEGRA INC
ENGINEERING PARTS LIST

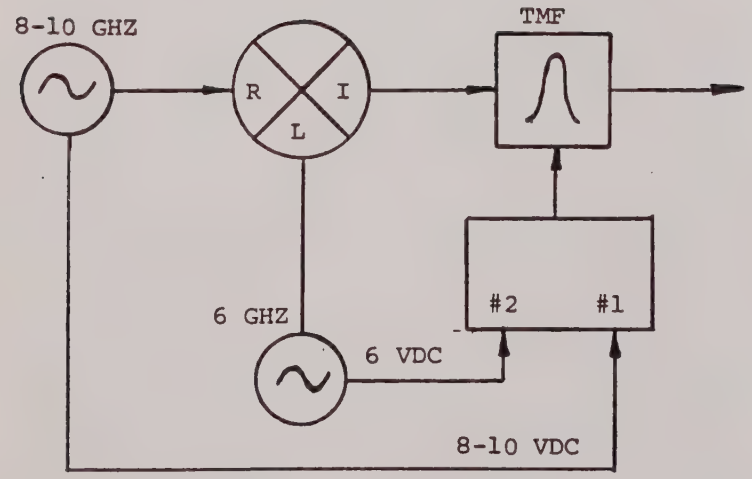
ASSEMBLY # A210390-04
USED ON TMF-1800H
NEXT ASSEMBLY STOCK
TITLE IEEE 488 INTERFACE BOARD

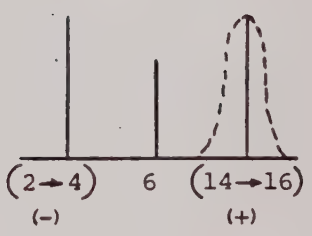
1 2 TC	DATE	7 9 CC	PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A2	10390-04			IEEE 488 INT BD	010	E	C	0001			37	2	STOCK	5
		13	10100088			C CER 0.01 UF	011	E	7	0001	C 1,3,4,6,16-20,24,25		37	3	10390-04	5
		13	10100968			C MICA 24 PF	020	E	7	0001	C 21, 22		37	3	10390-04	5
		13	10101900			C ELEC 10 UF	040	E	7	0001	C 2,5,7,23		37	3	10390-04	5
		13	10101936			C ELEC 4.7 UF	020	E	7	0001	C 14,15		37	3	10390-04	5
		14	10101958			CRYSTAL, 11.0596MHZ	010	E	7	0001	Y 1		37	3	10390-04	5
		15	10100019			DIODE	010	E	7	0001	CR 11		37	3	10390-04	5
		15	10101633			DIODE, 1N4004	030	E	7	0001	CR 1-3		37	3	10390-04	5
		17	10100382			LED, RED	040	E	7	0001	CR 7-10		37	3	10390-04	5
		19	10100114			IC, LM741	010	E	7	0001	IC 21		37	3	10390-04	5
		19	10101109			IC, DAC-71-CCD-V	010	E	7	0001	IC 1		37	3	10390-04	5
		19	10101891			IC, SN74LS00N	010	E	7	0001	IC 6		37	3	10390-04	5
		19	10101933			IC, 74LS138	010	E	7	0001	IC 7		37	3	10390-04	5
		19	10101934			IC, 75161	010	E	7	0001	IC 19		37	3	10390-04	5
		19	10101935			IC, 75160	010	E	7	0001	IC 20		37	3	10390-04	5
		19	10101939			IC, 8039-L	010	E	7	0001	IC 8		37	3	10390-04	5
		19	10101940			IC, 74LS373	010	E	7	0001	IC 18		37	3	10390-04	5
		19	10101941			IC, 2716	010	E	7	0001			37	3	10101956	5
		19	10101942			IC, TMS9914NL	010	E	7	0001	IC 16		37	3	10390-04	5
		19	10101943			IC, 74LS86	010	E	7	0001	IC 15		37	3	10390-04	5
		19	10101944			IC, 74LS74	010	E	7	0001	IC 14		37	3	10390-04	5
		19	10101945			IC, 8243	030	E	7	0001	IC 9,10,13		37	3	10390-04	5
		19	10101956			IC, PROM 8K	010	E	3	0001	IC 17		37	3	10390-04	5
		25	10101837		A	PCB	010	E	7	0001			37	3	10390-04	5
		27	10100110			R CARB 10K	090	E	7	0001	R 5,6,11-14		37	3	10390-04	5
		27	10100225			R CARB 33K	010	E	7	0001	R 27		37	3	10390-04	5
		27	10100286			R MF 20.0K	010	E	7	0001	R 20		37	3	10390-04	5
		27	10100303			R CARB 510K	010	E	7	0001	R 1		37	3	10390-04	5
		27	10100304			R CARB 1K	010	E	7	0001	R 28		37	3	10390-04	5
		27	10100411			R CARB 3.3M	010	E	7	0001	R 3		37	3	10390-04	5
		27	10101008			R MF 19.1K	010	E	7	0001	R 33		37	3	10390-04	5
		27	10101937			R CARB 160	040	E	7	0001	R 29-32		37	3	10390-04	5
		27	10101938			R SIP 33K	010	E	7	0001	RP 1		37	3	10390-04	5
		28	10100317			R VAR 2K	010	E	7	0001	R 23		37	3	10390-04	5
		28	10100319			R VAR 10K	010	E	7	0001	R 16		37	3	10390-04	5
		28	10100321			R VAR 50K	020	E	7	0001	R 2,4		37	3	10390-04	5
		30	10100095			TRANS, 2N4126	030	E	7	0001	Q 1,3,4		37	3	10390-04	5
		41	10100084			SOCKET, 14 PIN	030	E	7	0001			37	3	10390-04	5
		41	10100085			SOCKET, 40	020	E	7	0001			37	3	10390-04	5
		41	10100124			SOCKET	010	E	7	0001			37	3	10390-04	5
		41	10100128			SOCKET, 16 PIN	010	E	7	0001			37	3	10390-04	5

1 2 TC	DATE	7 9 CC	PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		41	10100131			SOCKET, 24 PIN	050	E	7	0001			37	3	10390-04	5
		41	10100818			TERMINAL	010	E	7	0001	TP 1		37	3	10390-04	5
		41	10101122			SOCKET, 20 PIN	030	E	7	0001			37	3	10390-04	5
		41	10101624			CONN, 2 PIN	010	E	7	0001	J 4		37	3	10390-04	5
		41	10101625			CONN, 16 PIN	010	E	7	0001	J 2		37	3	10390-04	5
		41	10101815			CONN, 26 PIN	010	E	7	0001	J 3		37	3	10390-04	5

OPTION -03 FOR TMF-1800H-L AND HPF-220 (OFFSET CONTROL)

OPTION -03 provides a second analog control input of 1 V/GHz or 1/2 V/GHz. This second input is added to the regular analog control input when the offset switch (S1-1) is set to "ON" and the input is subtracted from the regular input when (S1-2) is set to "ON". The polarity switch allows auto tracking of the upper or lower sideband. See Fig. 1 for block diagram and Fig. 2 for Rear Panel Connections.





OFFSET OPTION-03
FOR TMF-1800H-L and HPF-220

Before using the OFFSET input verify that the switches (S1-1 through 8) have been set to accommodate the input.

NOTE: Do not have both S1-1 and S1-2 CLOSED at the same time!

Switch Closed)	Function
S1-1	Positive offset
S1-2	Negative offset
S1-3	NC
S1-4	F1 control disengage
S1-5	NC
S1-6	NC
S1-7	1V/GHz select
S1-8	0.5V/GHz select

Example setting:

For use with an HP-SWEEP OSCILLATOR 8350B connect the 1V/GHz output to the OFFSET INPUT. Open the top cover to the CONTROLLER with the POWER OFF and select S1-7 (located on offset board on front panel). Also select S1-4 to fine-trim the offset with R20 (F1): F2 is always in (R13). Determine which way the filter is to be offset and select either S1-1 or S1-2.

Turn on the POWER to both the SWEEPER and the CONTROLLER. Set the sweeper to the low end and adjust R20 to peak the signal. Next set the sweeper to the upper end and peak the signal with R13. Repeat both steps until the filter is aligned. The CONTROLLER is now ready to operate in a system (replace top cover).

See assembly print B210538-01 for S1, R20, and R13 locations.

TEST TYPE: Final/*/Cal/ /Pre/ /
Unit: TMF-1800H-L and HPF-220
Board Name: OFFSET CONTROL
Assembly or PCB No: A210538-01 Rev A
Date 1/29/86

NOTES & INSTRUCTIONS:
DO NOT HAVE ANYTHING CONNECTED TO PRIMARY INPUT-UNIT NOT IN REMOTE MODE. CONNEC
VOLTAGE CALIBRATOR TO OFFSET INPUT. OPEN SWITCHES S1 (1-8) ON OFFSET CONTROL.
CONNECT DVM - TO R31 TOWARD OUTSIDE EDGE OF PCB.

TEST #	TEST TITLE	SET-UP / INPUTS	DVM ON	OSC ON	ADJ	MEASURE/ADJUST FOR
	ZERO OFFSET	Set Calib to 0V. Close S1 (7)	CH1- 1		R12	0.000V
	1V GAIN ADJ	Set calib to +19.999V (H,J,K,M) +19.999V (HPF) + 2.000V (L1,L2)	CH1- 1		R5	-9.840V (H,J) -9.840V (HPF) -7.426V (K,M) -8.500V (L1,L2)
	1/2V GAIN ADJ	Set calib to +10.00V (H,J) +10.00V (HPF) +12.250V (K,M) + 1.000V (L1,L2) Open S1 (7) Close S1 (8)	CH1- 1		R8	-9.840V (H,J,K,M) -9.840V (HPF) -8.500V (L1,L2)
	IC3 ZERO	Set calib to 0V. switch S1 (2) closed.	CH3- 12*		R23	0.000V
	F1 RANGE	Switch S1 (4) closed R20 (F1) CW.	CH13- 12*		R20	Approx -50mv
	F1 RANGE	R20 (F1) CCW,	CH13- 12*		R20	Approx -50mv
	F1 ZERO		CH3- 12*		R20	0.000V

* on mother board

TEST TYPE: Final/*/Cal/ /Pre/ /
Unit: TMF-1800H-L and HPF-220
Board Name: OFFSET CONTROL
Assembly or PCB No: A210538-01 Rev A
Date 12/07/83

TEST #	TEST TITLE	SET-UP / INPUTS	DVM ON	OSC ON	ADJ	MEASURE/ADJUST FOR
	F2 RANGE	Input +10.000V (H,J)	CH13-12*		R13	<-9.865V (H,J,K,M)
		+10.000V (HPF)				<-9.865V (HPF)
		+ 1.000V (L1,L2)				<-8.600V (L1,L2)
		+13.250V (K,M)				
		R13 (F2) CCW				
	F2 RANGE	R13 (F2) CW			R13	>-10.050V (H,J,K,M)
						>-10.050V (HPF)
						>-10.900V *L1,L2)
	F2 GAIN SET				R13	-10.000V
	(+) OFFSET ZERO	Open S1 (2), close S1 (1)			R28	0.000V
		Input zero volts.				
	+ OFFSET GAIN	Input +10.000V (H,J)			R24	+10.000V
		+10.000V (HPF)				
		+12.250V (K,M)				
		+ 1.000V (L1,L2)				
		-(ALL DONE)				
		LEAVE SWITCHES				
		S1 (2,3,5,6, & 8) Open				
		S1 (1,4, & 7) Closed				
	1V/GHz input, F1 IN & (+) offset.					

* on mother board

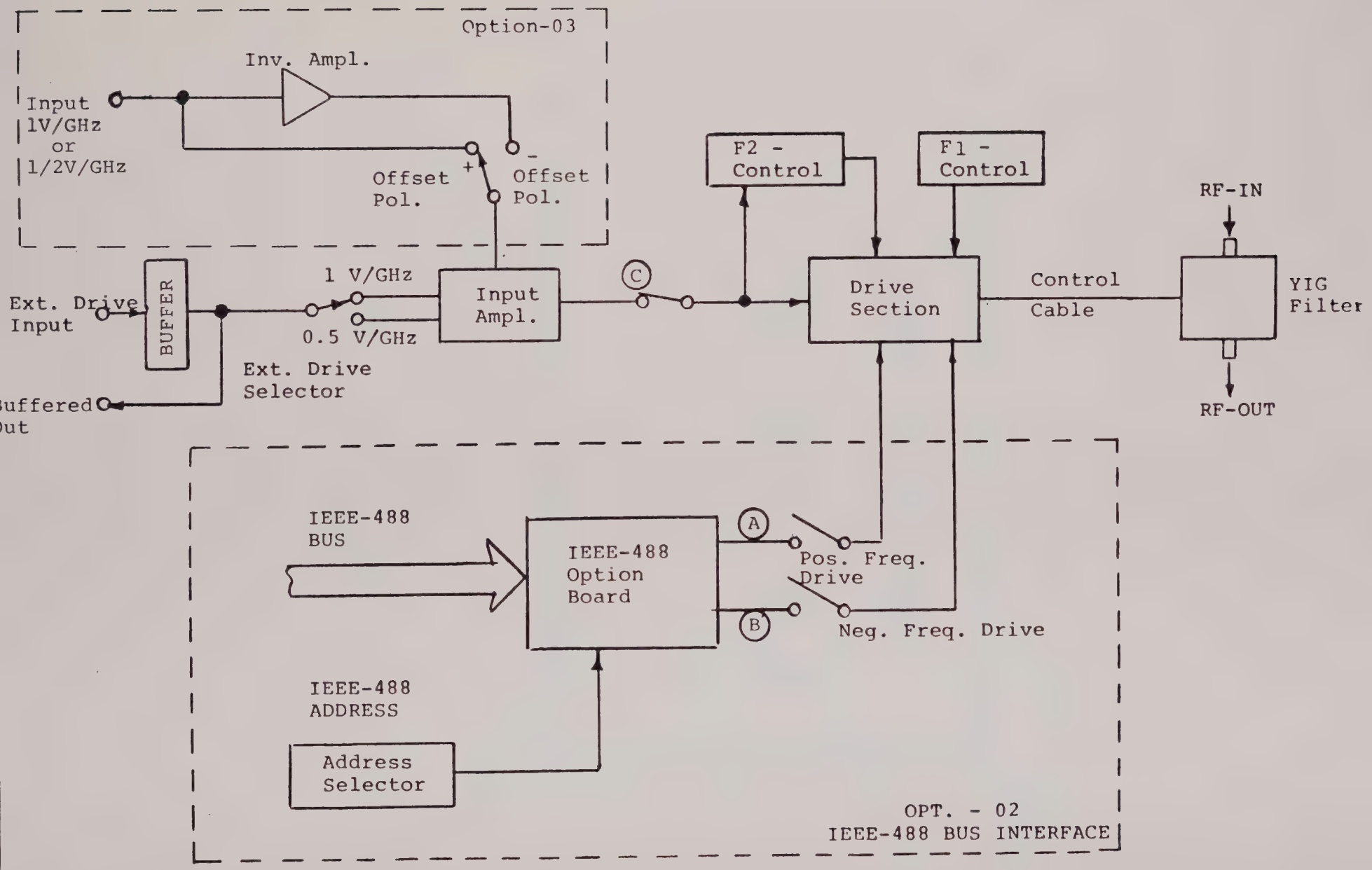


Fig. 1 TMF-Block Diagram

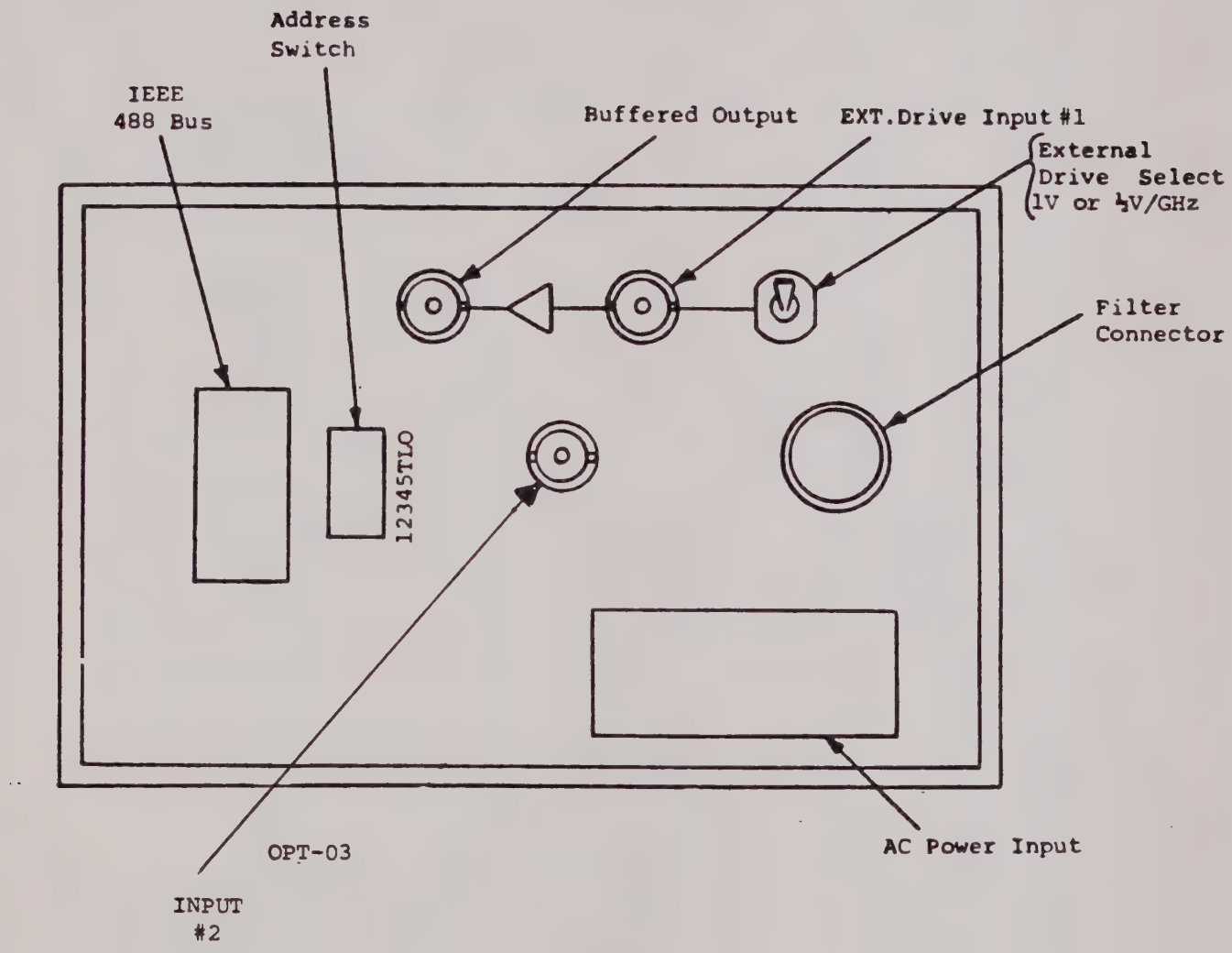
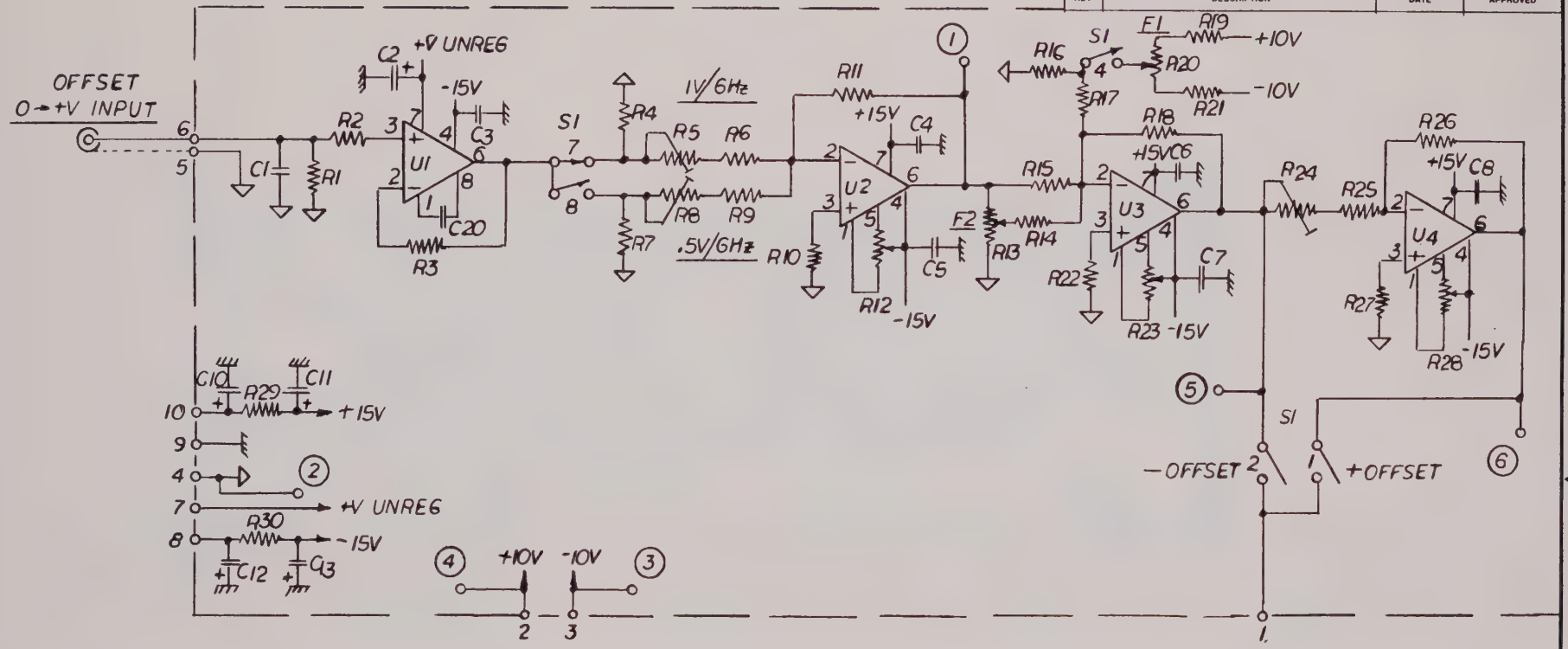


FIGURE 2 REAR PANEL TMF-1800H



LAST USED : C20, R30,

QTY REQD	FSCM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

	TMF-1800H
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS DECIMALS ANGLES
.XX ±
.XXX ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN	10/17/83
CHECKED	
ISSUED	

INTEGRA

OFFSET CONTROL

SIZE	FSCM NO.	DWG. NO.	REV.
B	51162	B110538-01	A

SCALE SHEET

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

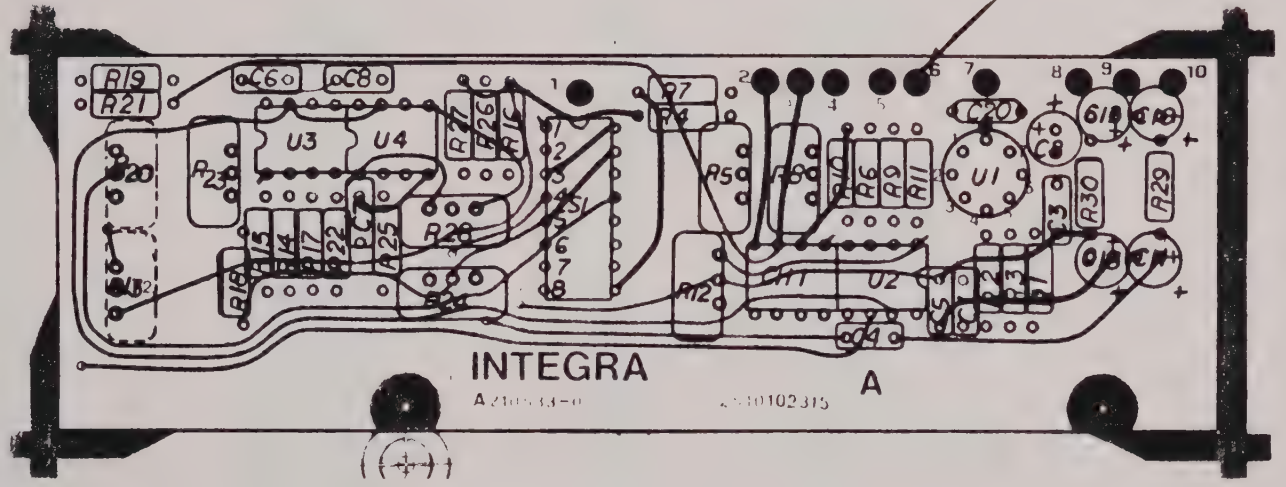
DWG. NO. SH REV.

BISHOP GRAPHICS, INC
REORDER NO 20510

DWG. NO.	SH	REV.

REVISIONS

REV.	DESCRIPTION	DATE	APPROVED



	QTY REQD	FSCM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

	TMF-1800H
	J
	K
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN	11-4-87
CHECKED	
ISSUED	

INTEGRA

OFFSET BOARD

SIZE	FSCM NO.	DWG. NO.	REV.
B	51162	B210538-01	A

SCALE | SHEET

BISHOP GRAPHICS, INC.
REORDER NO. 20510

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210538-01
USED ON TMF-1800H
NEXT ASSEMBLY A210467-02
TITLE OFFSET CONTROL

1 2 TC	DATE	7 9 CC	PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/F	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A2	10538-01		A	OFFSET CONTROL	010	E	C	0001					10467-02	5
		13	10100434			C MICA 91PF	010	E	7	0001	C 20				10538-01	
		13	10100543			C CER .01UF	080	E	7	0001	C 1-8				10538-01	
		13	10101900			C ELECT 10UF	050	E	7	0001	C 2,10-13				10538-01	
		19	10100114			IC LM 741	030	E	7	0001	U 2-4				10538-01	
		19	10102059			IC LM 344	010	E	7	0001	U 1				10538-01	
		25	10102315			PCB	010	E	7	0001					10538-01	
		27	10100286			R MF 20.0K	030	E	7	0001	R 11,15,18				10538-01	
		27	10100289			R MF 10.0K	010	E	7	0001	R 26				10538-01	
		27	10100290			R MF 4.99K	010	E	7	0001	R 27				10538-01	
		27	10100313			R CARB 2.7	020	E	7	0001	R 29,30				10538-01	
		27	10100436			R MF 49.9K	040	E	7	0001	R 2-4,7				10538-01	
		27	10100442			R MF 9.76K	010	E	7	0001	R 25				10538-01	
		27	10100585			R MF 39.2K	010	E	7	0001	R 6				10538-01	
		27	10100599			R MF 100K	020	E	7	0001	R 1,16				10538-01	
		27	10101088			R MF 19.1K	020	E	7	0001	R 9,22				10538-01	
		27	10101132			R MF 3.92K	020	E	7	0001	R 19,21				10538-01	
		27	10101636			R MF 732K	010	E	7	0001	R 14				10538-01	
		27	10102173			R CARB 2M	010	E	7	0001	R 17				10538-01	
		28	10101960			R VAR 1K	010	E	7	0001	R 8				10538-01	
		28	10101961			R VAR 2K	010	E	7	0001	R 5				10538-01	
		28	10101962			R VAR 10K	050	E	7	0001	R 12,13,20,23,28				10538-01	
		28	10102009			R VAR 500	010	E	7	0001	R 24				10538-01	
		41	10100124			SCOKET, 8 PIN	030	E	7	0001					10538-01	
		41	10100818			TERMINAL	100	E	7	0001					10538-01	
		41	10101852			SWITCH, DIP	010	E	7	0001					10538-01	

INTEGRA FILTER

February 6, 1985

OPTION 04

1.0 Fo OPERATION

The Fo control is used to manually tune the filter from F-min. to F-max., as specified by TMF or HPF model number. To use this mode, place the front panel switch in the Fo position. In the Fo mode, F1 and F2 controls can be used as verniers to set the low and high end frequency limits respectively. The filter center frequency is indicated on the LED display.

2.0 F1-F2 OPERATION

In the F1-F2 position, the Fo control does not function. In this normal operating mode; ie, F1-F2, the display will follow the external input (1V/GHz, 0.5V/GHz, IEEE-488).

3.0 IEEE-488 OPERATION

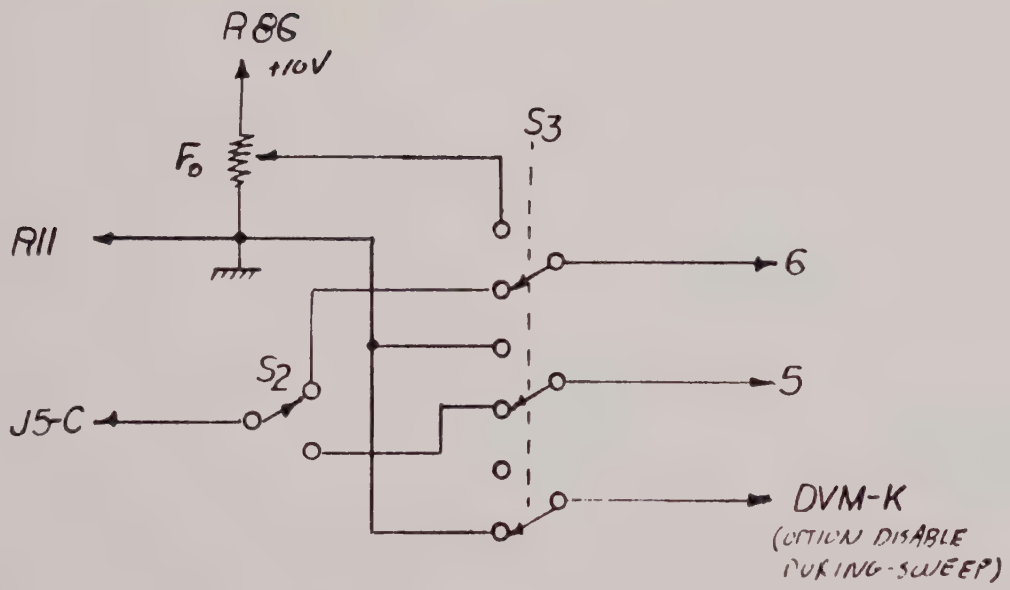
IEEE-488 can take command in either mode if the unit is equipped with option-02. The selected frequency will be displayed.

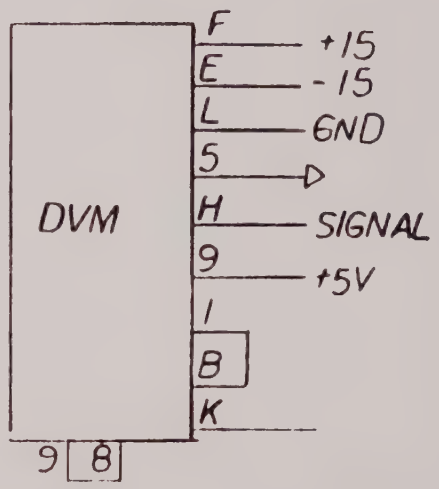
4.0 DISPLAY BLANKING

If display blanking is desired in the F1-F2 mode, connect the brown lead in the harness to the DVM edge connector at position (K). This will inhibit the LED display.

Fltr/Encl/AK

REV.	DESCRIPTION	DATE	APPROVED
OP4	add to B110451-01 1of1	2-6-85	





QTY REQD	FSCM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

	-04 opt
	H, J
NEXT ASSY	USED ON

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN	2-6-85
CHECKED	
ISSUED	2-6-85

INTEGRA

OPT-04 FOR TYPE II CONTROL UNIT

SIZE	FSCM NO.	DWG. NO.	REV.
A	51162	B110456-01	

SCALE

SHEET 2 of 2

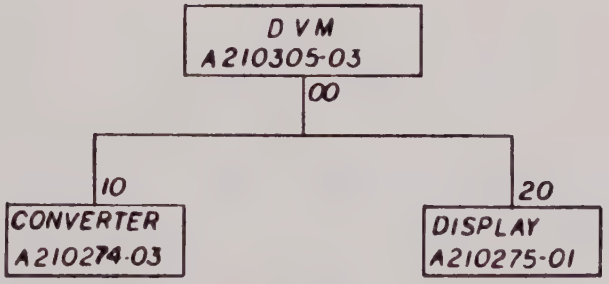
BISHOP GRAPHICS, INC

DWG. NO.	SH	REV.

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

LEVEL 0

L 1



QTY REQD	FSCM NO	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS DECIMALS ANGLES
(.XX °)
.XXX

CONTRACT NO

APPROVALS	DATE
DRAWN D M (APPROVED)	9-17-81
ISSUED	9-21-81

INTEGRA

PRODUCT STRUCTURE

SIZE	FSCM NO	DWG NO	REV
B	51162	B710305-03	

SCALE | SHEET

	NF-XXX
NEXT ASSY	USED ON

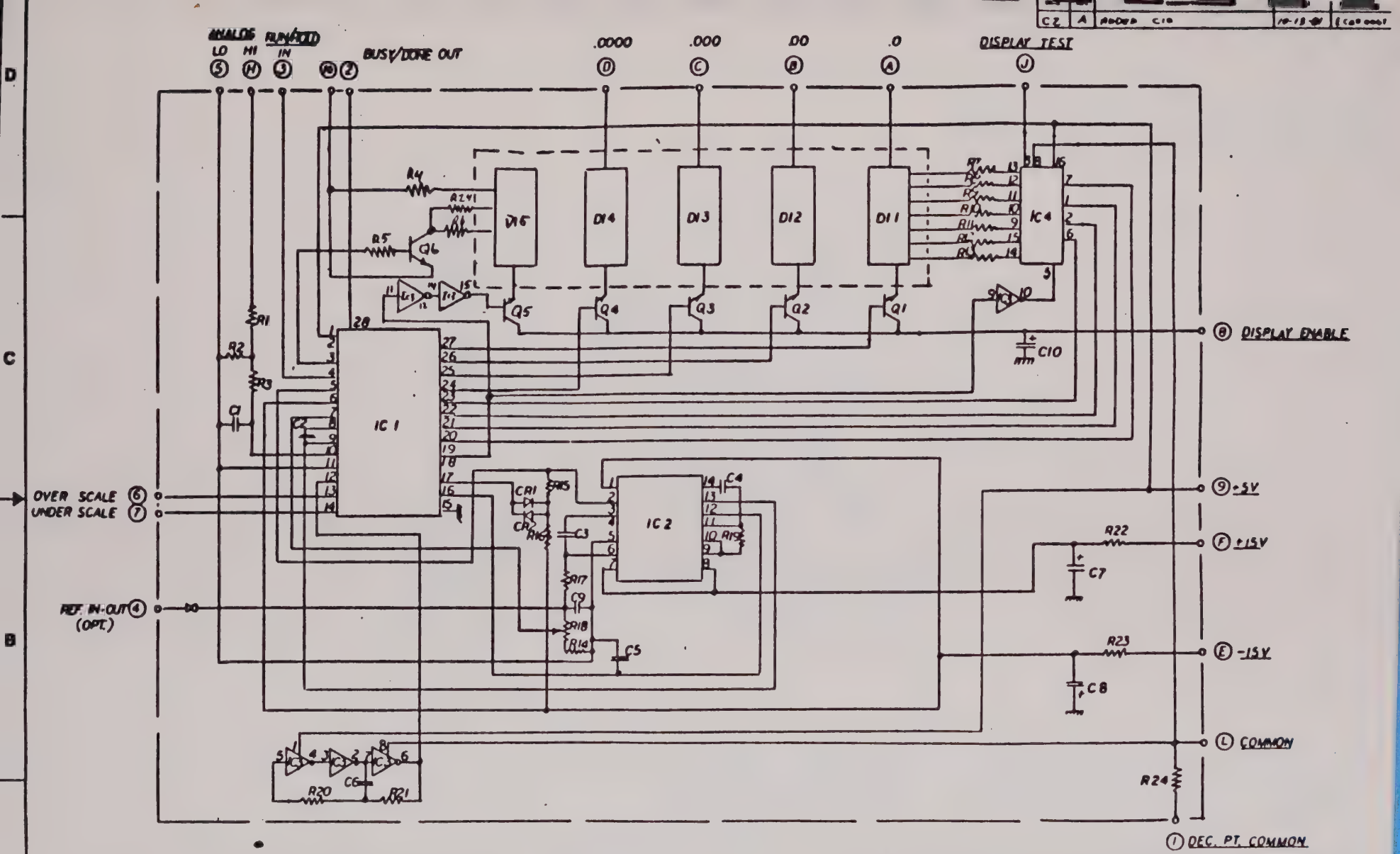
APPLICATION

MATERIAL

FINISH

DO NOT SCALE DRAWING

BISHOP GRAPHICS INC
REORDER NO 70510



NOTE:
-02 REMOVE R2 (VTS-1021)
-03 REMOVE Q1 (UTS-37421, (NF-YYX)
-04 " "

LAST USED: R24, 06, C10 IC4, CR2

	NF-XXX		
APPLICATION		DO NOT SCALE DRAWING	

PARTS LIST

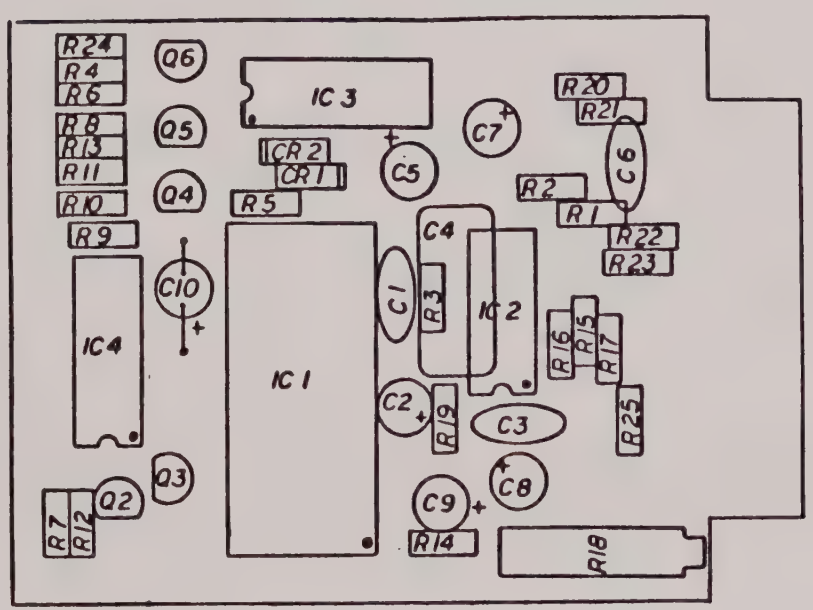
INTEERA

DVM CONVERTER

SIZE	FSCM NO	DWG NO
C	51162	B110274-01

SCALE | SHEET

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	ADDED C10	10-13-81	E.C.O.# 0067



QTY REQD	FSCM NO	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

CONTRACT NO.

INTEGRA

CONVERTER BD

	APPROVALS	DATE
DRAWN	PM	9.12.80
CHECKED	Paul McMenamin	10-13-81
ISSUED	H. Schmidt	11-5-81

MATERIAL

FINISH

DO NOT SCALE DRAWING

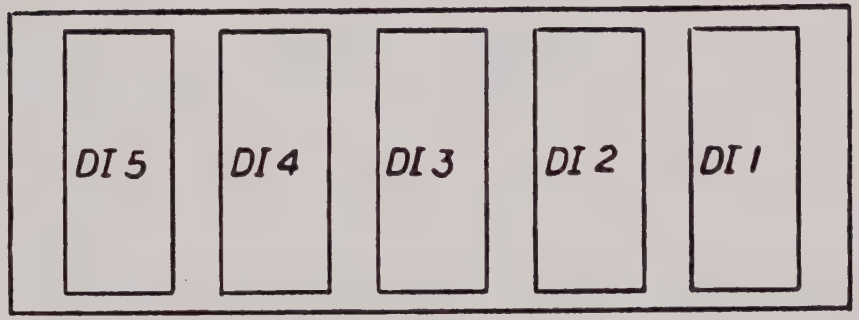
SIZE B | FSCM NO. 51162 | DWG NO B210274-03,04 | REV A

SCALE | SHEET

	NF-XXX
NEXT ASSY	USED ON
APPLICATION	

BISHOP GRAPHICS, INC
REORDER NO 20510

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED



QTY REQD	FSCM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

	VTS-101
	VTS-102
	NF-XXX
NEXT ASSY	USED ON

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL —

FINISH —

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN PM	9.12.80
CHECKED	
ISSUED	7-1-83

INTEGRA

DISPLAY BD.

SIZE	FSCM NO.	DWG. NO.	REV
A	51162	B210275-01	

SCALE | SHEET

BISHOP GRAPHICS, INC.

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210305-03
USED ON STOCK
NEXT ASSEMBLY END ITEM
TITLE DVM

1 2 TC	DATE	7 CC	9 PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/P	REP DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A2	10305-03			DVM	010	E	C	0001			00	0	END ITEM	5
		41	10101220			ENCLOSURE	010	E	7	0001			00	1	10305-03	5
		41	10101611			ACRYLIC SHEET	020	C	7	0001			00	1	10101689	5
		41	10101619			LABEL, S/N	010	E	7	0001			00	1	10305-03	5
		41	10101689			LENS, RED POLARIZED	010	E	3	0001			00	1	10305-03	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210274-03 REV B
USED ON DVM
NEXT ASSEMBLY A210305-03
TITLE CONVERTER BOARD

1 2 TC	DATE	7 9 CC	PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/P	REF DESIGNATION	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A2	10274-03		B	CONVERTER	010	E	C	0001			10	1	10305-03	5
		13	10101367			C FILM .22 UF	010	E	7	0001	C 4		10	2	10274-03	5
		13	10101369			C CER .001 UF	010	E	7	0001	C 3		10	2	10274-03	5
		13	10101370			C CER .01 UF	010	E	7	0001	C 1		10	2	10274-03	5
		13	10101371			C CER 100 PF	010	E	7	0001	C 6		10	2	10274-03	5
		13	10101900			C ELEC 10 UF	010	E	7	0001	C 9		10	2	10274-03	5
		13	10101905			C ELEC 22 UF	030	E	7	0001	C 7,8,10		10	2	10274-03	5
		13	10101953			C ELEC 1 UF	020	E	7	0001	C 2,5		10	2	10274-03	5
		15	10100019			DIODE, IN4148	020	E	7	0001	CR 1,2		10	2	10274-03	5
		19	10100243			IC, CD4049AE	010	E	7	0001	IC 3		10	2	10274-03	5
		19	10100630			IC, SN7447N	010	E	7	0001	IC 4		10	2	10274-03	5
		19	10100837			IC, ICL7103ACD1	010	E	7	0001	IC 1		10	2	10274-03	5
		19	10100851			IC, ICL8052CPD	010	E	7	0001	IC 2		10	2	10274-03	5
		25	10101357		A	PCB	010	E	7	0001			10	2	10274-03	5
		27	10100289			R MF 10.0K	010	E	7	0001	R 1		10	2	10274-03	5
		27	10100295			R MF 1.10K	010	E	7	0001	R 2		10	2	10274-03	5
		27	10100309			R CARB 100K	020	E	7	0001	R 3,19		10	2	10274-03	5
		27	10100313			R CARB 2.7	020	E	7	0001	R 22,23		10	2	10274-03	5
		27	10100522			R MF 4.7K	010	E	7	0001	R 5		10	2	10274-03	5
		27	10100592			R MF 4.22K	010	E	7	0001	R 17		10	2	10274-03	5
		27	10100608			R MF 5.62K	010	E	7	0001	R 14		10	2	10274-03	5
		27	10101333			R CARB 300K	010	E	7	0001	R 16		10	2	10274-03	5
		27	10101362			R CARB 36K	010	E	7	0001	R 15		10	2	10274-03	5
		27	10101363			R CARB 30K	010	E	7	0001	R 21		10	2	10274-03	5
		27	10101364			R CARB 12K	010	E	7	0001	R 20		10	2	10274-03	5
		27	10101365			R CARB 47	040	E	7	0001	R 4,6,24,25		10	2	10274-03	5
		27	10101366			R CARB 22	070	E	7	0001	R 7-13		10	2	10274-03	5
		28	10100315			R VAR 500 10T	010	E	7	0001	R 18		10	2	10274-03	5
		30	10100092			TRANS, 2N4124	060	E	7	0001	Q 1-6		10	2	10274-03	5
		41	10100084			SOCKET 14 PIN	010	E	7	0001			10	2	10274-03	5
		41	10100128			SOCKET 16 PIN	020	E	7	0001			10	2	10274-03	5
		41	10101286			SOCKET 28 PIN	010	E	7	0001			10	2	10274-03	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210275-01
USED ON DVM
NEXT ASSEMBLY A210305-03
TITLE DISPLAY BOARD

1 2 TC	7 DATE	9 CC	PART NUMBER	17 SUFF	18 REV	19 DESCRIPTION	40 QUA	43 U/M	44 SRC	45 E/P	REF DESIGNATIONS	63 M	64 T/P	70 L	71 NEXT ASSY	80 C
		A2	10275-01			DISPLAY BD	010	E	C	0001			20	1	10305-03	5
		17	10101057			LED, 5082-7730	040	E	7	0001	DI 1-4		20	2	10275-01	5
		17	10101349			LED, 5082-7736	010	E	7	0001	DI 5		20	2	10275-01	5
		25	10101358			PCB	010	E	7	0001			20	2	10275-01	5

www.manualsplus.com
1018137